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ABSTRACT

Thematic units, the basis of organization for this guide, work in many ways toward the dual goals of language and content area instruction. The thematic units presented here address topics of high interest to limited English-proficient (LEP) students, including: robots; using a computer data base; activities with plants; building terrariums; architecture; and cooking. In order to provide LEP students with an active role in the learning process, the units incorporate many opportunities for them to play games, participate in movement activities, enter into role playing, create art works and constructions, cook and manipulate materials. To bridge the gap between the classroom and the real world, the units incorporate field trips and other activities that provide LEP students with motivational experiences to facilitate their learning of the new culture as well as the new language. To help LEP students toward full literacy, the units use a whole language approach, including many experiences with rich literature, and opportunities to develop writing skills. In addition, the units are planned to incorporate the language, math, and science objectives of the Georgia Basic Curriculum. Each of the units in the guide includes an introductory statement of purpose, learning objectives, key concepts, a brief outline of activities, grade levels for which the unit is intended, and a list of suggested resources. Each unit addresses a range of several grade levels. Georgia Basic Curriculum objectives for each activity are displayed on a grid. Each activity includes recommended grouping and teacher role, a list of materials needed, detailed procedures, suggestions for evaluation, and possible extensions of the activity. (KR)

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Turn On Units

English as a Second Language Content Area Curriculum in Math, Science, and Computer Science for Grades K - 6

Mary Lou McCloskey, Editor
Cynthia Ashurst First
Janet R. Jones
Susan Putzell
Marianne Dunlap Sansom
Pat A. Schneider

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INTRODUCTION

Limited English-proficient (LEP) children have always been a part of the United States educational scene, but it is only in the last fifteen to twenty years that a clear national awareness of the unique learning needs of these students has emerged. In the late 1960's and early 1970's, legislative and judicial mandates dealing with the rights of LEP students to equal educational opportunity led to the creation of bilingual educational programs specifically designed to meet LEP students' needs. Most of these programs involved instruction in two languages (the students' native language and English) and were organized for programs with high concentrations of students from a single language background (e.g., Spanish/English programs in Texas; Vietnamese/English programs in California). Most of the existing published curriculum materials prepared for teachers of LEP students have been aimed at these dual language programs.

In 1987, both the demographics and the pedagogy of bilingual education are changing. Department of Education census projections indicate that the number of LEP students in the American population between the ages of 5 and 14 will continue to rise dramatically for at least the remainder of this century. No longer are LEP students concentrated in a very few states; rather, linguistic minority households are now found in communities across the country, in places where such differences have never existed or have been able to be ignored in the past. This trend has resulted in a much wider and a much more diverse distribution of LEP students in the public schools than ever before, with more and more school systems each year facing the enrollment of LEP students from several different language backgrounds in various grade levels and schools. This trend is evident in the state of Georgia, where the number of LEP students has increased an average of 12% per year since 1981 (Georgia Department of Education, December, 1984). Currently 72 school systems in Georgia report 7,052 non-English background students from at least 61 different language groups. Of these students, 2,884 are reported as LEP. Of these 72 school districts with non-English background students only two offer bilingual programs, and 14 offer English as a second language programs. Obviously, many regular classroom teachers, paraprofessionals and other public school personnel who have little special training and few materials are faced with the challenge of meeting the educational needs of LEP students.

School personnel face a further challenge in working with LEP students. While they must find time and means to help these students to acquire English proficiency, they must find ways to see that these students also learn the content area material expected of their age and grade level. During our work in training teachers of English as a Second Language (ESL), we have often observed how language minority children are foreclosed from instruction in math and science until their English language skills are at a certain level. Schools in the state of Georgia lack bilingual teachers in over fifty languages spoken by Georgia's LEP school children, and are thus unable to provide bilingual instruction in native languages in content areas. In many ways, the "pull-out" model followed by most ESL programs, in which students are taken out of the regular classroom for ESL instruction for part of the day, conflicts with the goal of providing content area instruction to LEP students. Though students miss instruction in content areas when they are taken out of the regular classes, the teachers of pull-out classes often see their roles as language teachers only, and do not see their responsibility to function as content area teachers as well. Students in "pull-out" programs, because of time limitations, are also likely to miss enrichment experiences such as classes in computer use. When they do have opportunities to use computers, they are generally for drill and practice in English, and do not introduce students to the language or logic of computers.

Problems are not diminished for LEP students who do not have "pull-out" ESL instruction. Their regular teachers are faced with the difficulty of giving the time and individual instruction necessary to teach these students while not taking instructional time from the rest of the class. At best, teachers resourcefully use peers and methods of their own device to include LEP students. At worse, the LEP students are neglected or isolated. Though LEP students may be present for content area instruction, they miss much of what is being taught because they are unable to read the texts or comprehend the lectures. Content area material may be cognitively appropriate for LEP students, but the presentation of the material may exclude them.

Fortunately, the recent literature examing the processes of language development has yielded a number of new insights which have the potential for being transformed into instructional practices for assisting LEP students in both the ESL and regular classroom. Increasing evidence from recent multi-dimensional, qualitative studies (see reviews by Berko-Gleason and Weintraub, 1978, and Lindfors, 1980) suggests that children's language development is a strongly interactive process, one which relies not only on specific (and perhaps innate) cognitive and linguistic mechanisms, but also on the child's active participation in a linguistic environment attuned to the child's communicative needs. This communicative view of language development is expressed in many forms today, and has been proposed as a set of assumptions and criteria as a basis for a "communicative" or "natural" curriculum (Savignon, 1983; Krashen and Terrell, 1983; Enright and McCloskey, 1985).

In the communicative approach children are seen as learning language as a means of communication. The second language is acquired by purposeful interaction with the language environment, and this acquisition is enhanced by input that is meaningful and interesting to them (Urzua, 1985; Dulay, Burt, and Krashen, 1982), and takes advantage of all of students' available resources: linguistic and nonlinguistic, internal (cognitive, affective) and external (social, environmental). The input is provided in a comfortable classroom atmosphere which encourages and celebrates efforts at communication and which focuses on the meaning of utterances rather than on their form, treating errors as part of the language acquisition process.

Because this communicative approach is wholistic and integrative, it can be an effective way to solve the problem of teachers who find themselves faced with the "language - content" dilemma. Communicative lessons can be designed which teach language through content, using a presentation that requires active participation on the part of students. Teaching language through content will help students to acquire language more quickly and to master content area skills at the same time.

This curriculum guide was written to serve two purposes: (1) to provide communicative teaching units which teachers can immediately put to use to teach both content area and language objectives, and (2) to provide teachers with a model for planning curricular activities which meet both the specific content area and specific language needs of their own students. After using these units, teachers will be able to use the model and their own materials to construct additional units of their own which serve these purposes.

The materials are intended for the use of both elementary teachers of English as a second language and for regular classroom teachers who have students learning English as a second language in their classrooms. These integrated units have been field-tested in both ESL and grade level classrooms, and while they were seen to promote language-learning for ESL students, they increased interest level and motivation for all.

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Description of the Guide

Thematic units, the basis of organization for this guide, work in many ways toward the dual goals of language and content area instruction. The thematic units address topics of high interest to students. These include robots, using a computer data base, plants, building terrariums, architecture, and cooking. In order to give students an active role in the learning process, the units incorporate many opportunities for students to play games, participate in movement activities, role play, create art works and constructions, cook and manipulate materials. In order to provide a variety of types and levels of input, the units incorporate large group activities, small group activities, independent work at learning centers, and many different teacher roles. To bridge between the classroom and the real world, provide students with motivational experiences and help children learn the new culture, as well as the new language, the units incorporate field trips. To help students toward full literacy, the units use a whole language approach, including many experiences with rich literature, and opportunities to develop writing skills. In addition, the units are planned to help students achieve language, math, and science objectives of the Georgia Basic Curriculum, Most importantly, the thematic units help teachers and students to integrate teaching and learning in language and content areas.

Each of the units in the guide includes an introductory statement of purpose, including objectives, key concepts, a brief outline of activities, and grade levels for which the unit is intended. Each unit addresses a range of several grade levels. Teachers are encouraged to adapt activities to their own students within that range. Many of the activities can be adapted beyond the range, as well. Georgia Basic Curriculum objectives for each activity are displayed on a grid. Each activity includes recommended grouping and teacher role, a list of materials needed, detailed procedures, suggestions for evaluation, and possible extensions of the activity. A list of suggested resources is included at the end of each unit.

Teachers who use the guide will have a rich resource for teaching language, math, science, and computer skills together. It is the hope of the writers that after using these units, teachers will go on to create additional units of their own which use content as a medium for teaching language.

ROVING ROBOTS

by
Pat A. Schneider

Unit 1: Grades K-3

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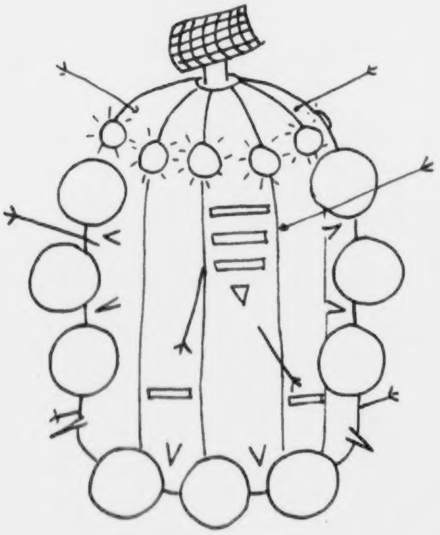
ROVING ROBOTS

Robots -- flying on TV, saving mankind in the movies, turning into space ships in toy stores, and shaking hands in shopping malls -- have become an integral and exciting part of the modern child's life. Students of all ages and cultures are affected by this motivating, cross-cultural tool for teaching a multitude of computer science and language concepts.

As future members of a computerized society, all of today's students must learn to differentiate between fantasy robots and real-life working robots. Students need a realistic understanding of the functions, possibilities, and limitations of robots in today's world. Because the concepts and vocabulary of computer science are usually unfamiliar to both English-speaking and non-English speaking students, all students begin this unit on equal footing. Therefore this unit may help to bridge the culture and language gap between these groups.

This unit integrates diverse teaching strategies, including role play, puppetry, large and small groups, peer teaching, centers, field trips and games. It also encompasses many subject area concepts, including science, mathematics, language arts, visual arts, and physical education. Throughout the lessons and extensions, students are encouraged to apply the language acquired at a variety of levels.

Many of the activities within the unit build upon language and concepts introduced in a prior lesson. In order to assure that students gain a clear understanding of the computer science concepts being taught, the sequence within the unit should be followed.



ROVING ROBOTS
OBJECTIVES

Activities **Objectives** **Unit 1 / Grades K-3**

1	2	3	4	5	6	7	8	**MATHEMATICS**
				●				Recognizes, names, and counts whole numbers from 1 to 10 in the context of everyday activities (GBC K,1,2,3).*
				●	●			Recognizes elements of sets in the context of everyday activities (GBC K,1,2,3).
				●	●	●		Sorts, compares, and arranges objects according to size and shape (GBC K,1,2,3).
				●	●	●		Demonstrates spatial orientation in completing a product.
				●				Recognizes and uses ordinal numbers (GBC K,1,2,3).

1	2	3	4	5	6	7	8	**SCIENCE / HEALTH**
			●				●	Identifies motion such as push/pull (GBC K).
						●	●	Recognizes interdependence of machine parts (GBC 1,2,3).
						●		Creates and uses simple machines (GBC K,1,2,3).
●	●	●	●	●		●		Sorts and describes objects by shape, color, size, texture, and other attributes (GBC K,1,2,3).
			●	●			●	Identifies directional motion: back/forth; up/down; etc. (GBC 1).
			●					Demonstrates ways to care for the teeth (GBC K,1,2,3).
●	●		●	●				Names terms for body parts and senses.
		●						Participates in developmental activities related to strength, heart-lung endurance and flexibility (GBC K,1,2,3).
●	●		●	●				Understands directions of left, right, up and down (GBC 1).
●				●	●			Identifies basic emotions (GBC 2).

1	2	3	4	5	6	7	8	**COMPUTER SCIENCE**
●							●	Demonstrates an understanding of the relationship between a robot feature and its function.
●					●		●	Demonstrates an understanding of robots as specialized computers which work for people who design them.
	●				●			Illustrates which parts of the body function as input, output, input/output and memory devices.
	●	●						Demonstrates an understanding of the concepts of specific robot functions, memory, and *input/output devices.*

ROVING ROBOTS

OBJECTIVES

Activities **Objectives** Unit 1 / Grades K-3

1	2	3	4	5	6	7	8	**COMPUTER SCIENCE** (continued)
			•	•	•	•	•	Demonstrates an understanding of the need for specific language and sequence in giving directions to robots.
			•	•	•	•	•	Demonstrates an understanding that robots perform according to a specific, sequenced list of commands called a program.
					•	•	•	Demonstrates an understanding of the use of robots on an assembly line.

1	2	3	4	5	6	7	8	**ART**
•		•		•	•		•	Communicates ideas and experiences through artwork (GBC K,1,2,3).
•		•			•		•	Using elaborated language, students express thoughts, feelings and ideas regarding their own artworks (GBC K,1,2,3).
•		•			•		•	Creates original artworks in association with writing, storytelling, events, and creative dramatics (GBC K,1,2,3).
•	•	•		•			•	Creates artworks which demonstrate an awareness of details observed in the environment (GBC K,1,2,3).

1	2	3	4	5	6	7	8	**LANGUAGE**
•	•	•	•	•	•	•	•	Participates in oral activities as active listener for appreciation, gathering information, following directions, recognizing cause and effect relationships, sequencing, and making predictions (GBC K,1,2,3).
•	•		•				•	Tells stories or describes experiences clearly and in sequence (GBC K,1,2,3).
•	•		•	•				Distinguishes between fantasy and reality (GBC 2,3).
•	•	•	•	•	•	•	•	Understands and uses a basic functional vocabulary related to the environment (GBC K,1,2,3).
•	•	•	•		•	•	•	Uses elaborated language to describe, analyze, and interpret objects, events, feelings, and their relationships (GBC K,1,2,3).
•	•		•	•				Classifies words (GBC K,1,2,3).
•	•	•	•	•	•	•	•	Demonstrates a variety of ways to communicate, including dramatic, oral, written and artistic presentations.
	•		•	•	•	•		Interprets written instructions (GBC 2,3).

*Georgia Basic Curriculum Objective for listed grade level(s).

1. ROBOT FANTASY

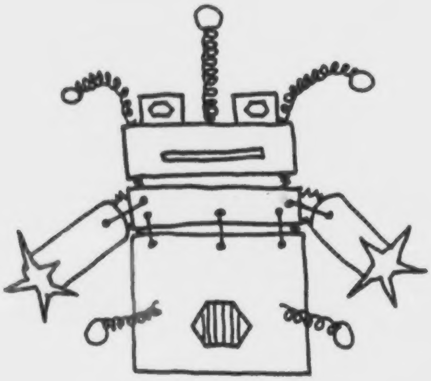
Be prepared for wonderful daydreams. Also be careful that students don't fall into the trap of imitation. I had to work hard to lead students away from creating 15 robots who would get rid of the "bad guys" for me, but our final results were 15 unique robots!

Procedures:

Large group, teacher directed
Individual, independent work

1. Introduce your students to the robot. Have students tell the robot what they think about when they hear the word "robot." Have the robot ask students to fantasize about what they would like it to do for them. By elaborating on student comments, encourage students to use verbs and objects in their sentence structures, e.g., **clean my closet, wash my car**, and prepositional phrases, e.g., **fly me to the moon, throw a ball out of the field, catch a frisbee with one finger**. As students dictate their ideas, write them on chart paper. If some students have difficulty with dictation, have them act out the tasks the robot might do and have peers interpret the actions for dictation.

2. After all students have made statements about the functions of robots, ask them to describe in words or actions a necessary feature their robots must have to perform their functions. Use follow-up questions to be sure the students describe the reason for this feature and what it will do. For example, a robot which cleans out a student's closet might have eyes that extend to see on top of shelves or around boxes in order to find missing toys. As students talk, draw each needed feature on a large poster or chart in order to come up with a class composite fantasy robot.



3. Display the statements and the fantasy robot in the classroom to motivate further exploration and to facilitate review. Use the robot's features as context clues for reading the statements dictated by the students.

Evaluation:

Complete Extension #1 and have students talk to you about the parts of the robot they are creating. Observe whether each student is able to name the part, its function, and his/her reason for making it look the way it does.

Extensions:

1. Using the composite robot as a starting place, have each student choose one feature for elaboration using construction paper and markers. In order to create a mural-sized collage of fantastic specialized robot parts, attach each labeled student creation to a bulletin board.

2. Invite an expert who would demonstrate and explain to students the functions and limitations of a "real" robot.

3. Fernando Krahn's *Robot-Bot-Bot* is an excellent picture book of what robots can do for people. See references at the end of this unit.

Materials:	Large posters or chart paper Robot Puppet - Since young children are often more open with a puppet, this lesson is best introduced by a "robot puppet." You can easily construct one from cardboard tubes and cans painted or covered with foil, and then attached in whatever shape you wish (see sample). Parts of the robot should be removable for use in a later lesson (see Activity 2).

2. INPUT/OUTPUT

This is a great ice breaker, especially if you set the mood for fun! Acting is universal and communication through more than just words points out student similarities rather than differences. If you believe your students are not ready to role play, you might use the more concrete "senses" activity in Extension #1.

Procedures:

Large group,teacher directed
Center/peer teaching groups

1. Bring out your robot puppet, but have various parts (e.g., eyes, ears, mouth) missing so that it cannot "talk" with the students. The robot can no longer take in information or give out information. It has forgotten the students because it has no memory and cannot communicate. Before the students can "fix" the robot, they must explore their own bodies and their means of communication.

2. Set up, through description, magazine pictures, or "scenery," some of the situations listed below for input/output and memory role play. Have students dramatize the situations in order to discover what parts of their bodies allow them to take in information or "input." What parts of their bodies tell them to act on this information? What parts of their bodies allow them to give out information or "output?" Are there some that can function both as input and output?

The audience should describe clearly the actors' movements and reactions, and their causes. Emphasize this functional vocabulary: **input, output, memory, action, reaction, communication,** and the terms for the parts of the body and senses involved in the actions and reactions.

3. Later, at a center or in peer teaching groups, have students interpret the "key" or code in order to label the input, output, input/output, and memory parts of the body on the attached blackline master on the following page.

Possible Role Play Situations:

1. You walk into the kitchen and place your hand on a hot stove.
2. You look across the street and recognize a friend.
3. You walk barefooted across the sidewalk on a summer day.
4. You make lemonade with salt instead of sugar.
5. You see your new baby sister/brother for the first time.
6. You put ice cold water in your bathtub accidentally.
7. Your friend, without seeing a car coming, is about to step off the curb.
8. Your favorite song is playing on the radio.
9. There are strange sounds in the dark.
10. Your friend puts ice down your back.
11. You're eating your favorite/least favorite food.

Materials: List/magazine pictures of role play possibilities.
Space for acting out situations.

INPUT/OUTPUT

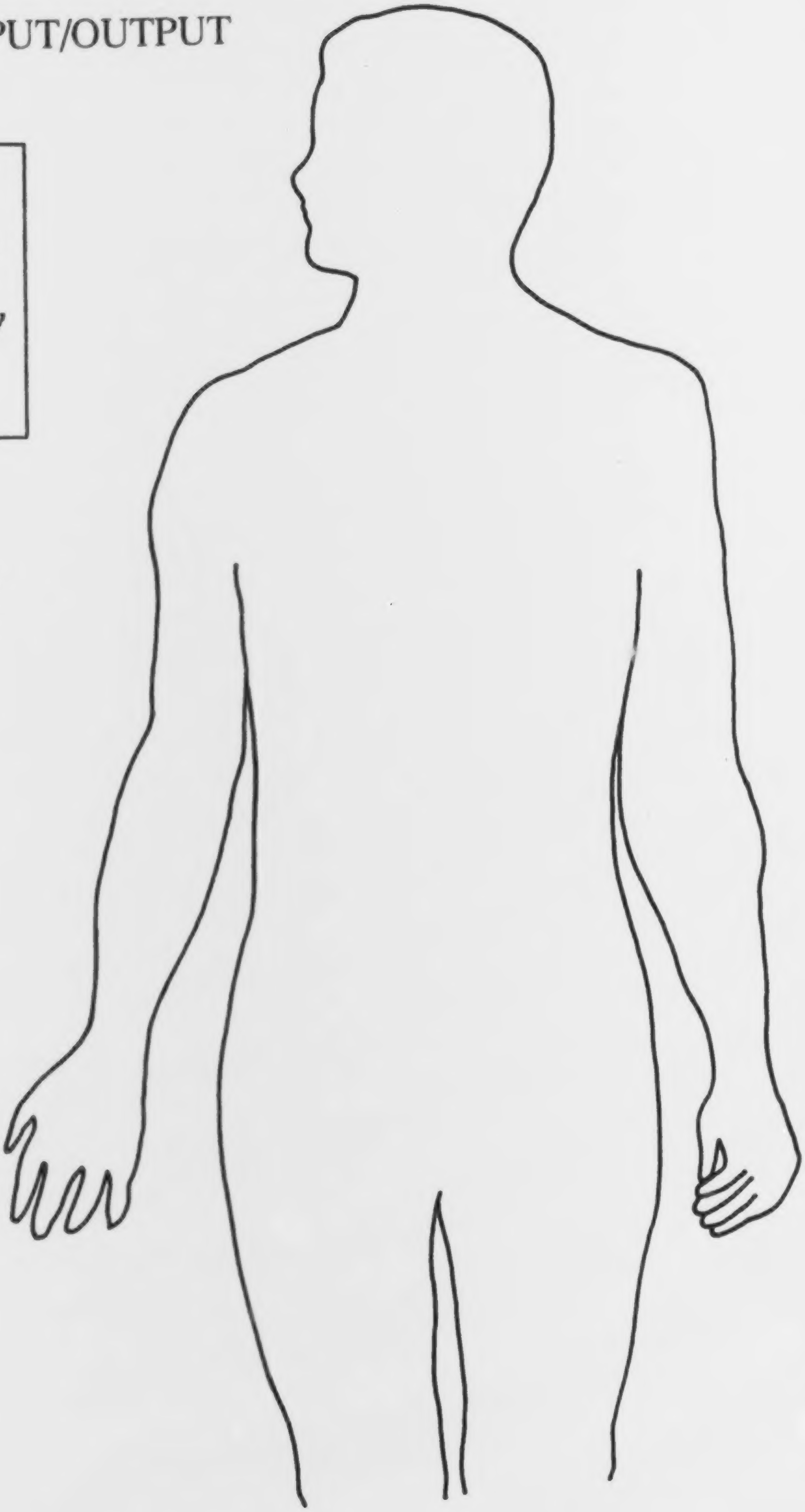
Key

○ Blue - Input only

○ Red = Output only

⊘ Blue\Red=I\O

Label the parts of the body. Use the key to show which parts are used for input, output and input\output.



Evaluation:

Observe the quantity and complexity of body and language communications used by the students during the role play activity. Assess students' performance in labeling input, output, and input/output features on the blackline master.

Extensions:

1. Have a series of items for students to compare by taste, sight, touch, sound, and smell. Use items that will trick one sense and allow students to depend on another. For example:

Can students tell white vinegar from water? White vinegar could certainly look like water, but though it fools the eye it won't fool the nose or tastebuds.

Can students distinguish between horns and bells? If students' eyes are screened, they can no longer help distinguish between horns, bells, etc. Students must use only their hearing.

Can students choose between sweetened or unsweetened tea or Koolaid by sight or smell?

Can students choose a designated color chip from a bag if they are blindfolded? Can they choose a described shape from a bag if they are blindfolded?

As students participate in these activities have students draw and describe their reactions to these items and what part(s) of their bodies took in the information and acted on it.

2. Have students pantomime an action and reaction and have other students list various situations which could have evoked the responses. For example, a dog jumps on a student, or a student releases an inflated balloon.

3. Show students pictures which evoke reactions or feelings and have them describe their reactions or feelings. Photographs from *The Family of Man* are excellent as are photographs in human interest magazines.

4. "Eliminate" a sense by blindfolding or bandaging students and have students experience and then discuss this "loss." How does the loss affect students' ability to react or communicate?

3. ROBOT CREATIONS

Making children's fantasy robots concrete with art materials eliminates language gaps. Sharing these imaginative robot creatures helps to bridge both cultural and age differences. A group of kindergarten and first grade students who created magnificent "robots" appeared to lose many inhibitions when they made their robots "perform" for third and fourth graders.

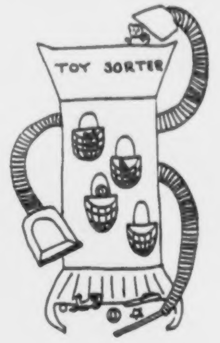
Procedures:

Large group, teacher directed
Individual, independent

1. Bring out the "incommunicative" robot from the previous lesson. Build on the role play or sense experiences to help students decide which parts of the robot need to be changed or added to in order for the robot to "see" them, "hear" them, "recognize" them, "speak" to them. Have students discuss what "senses" the robot must possess. What might these devices for communication look like? How would the robot remember? Where would it store needed information and what might these devices look like? Have materials out so that students can actually "fix" the robot by making and adding eyes, ears, mouth, hands, etc. Remember that appearance and placement of these sensors in robots may be radically different from their appearance and location in humans. For example, eyes may be located at the end of the antennae on a robot.

2. Give students a variety of material for creating their own two-dimensional or three-dimensional robots. Remind them to have the robot's functions in mind as they build it. As they build, ask students to point out parts for **input, output,** and **memory.**

3. Display creations. Have students name and describe the functions of their robots, once again reinforcing the terms **input, output,** and **memory.** Students, depending on age and proficiency, should either dictate to you or label, on their own, the parts for input/output and memory.



Evaluation:

Observe students conversations when playing robot roles.

Extensions:

1. Have groups stage "robot" performances for one another.

2. Have small groups of students allow their robots interact to create a community that would be run by robot power. Have students discuss the "good" and "bad" of this concept.

3. Use the two-dimensional "robots" created by the students as covers for computer folders.

4. Read robot literature to students. Have them write or dictate adventure stories about their own robot creations. We recommend Betty Baker's *Worthington Botts and the Steam Machine* and the chapter on "The Doughnut Machine" in Robert McCloskey's *Homer Price.* See the reference section.

Materials:

Construction paper, poster board.
Glue, tape.
Markers, crayons, paints.
Glitter, aluminum foil, stickers.
Feathers, pipe cleaners, wires, nuts and bolts .
Boxes, tubes, cans.

(Plan ahead and have parents help contribute workshop and kitchen "junk" to make your robots most exciting.)

4. THE ALIEN

Relax with this one. We've discovered that the more outlandish the alien costume the easier was the task of involving students and the less important our skill at mime.

Procedures:

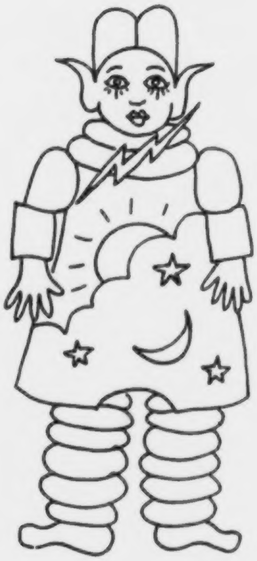
Large group, teacher directed
Small groups, teacher available

1. Don the alien costume. inform students that although your body has similar parts to theirs, many of the things that they do on earth are not done on your far-off planet. Tell them that you were sent to earth to understand their customs and the first thing you want to learn is how to brush your teeth.

2. Have students direct you to the bathroom, either a real or an imaginary one, and have them get you to brush your teeth. Act out each direction, using props or pantomime. Make it clear that if students do not use specific vocabulary or if they tell you to do something out of sequence, there will be a problem. Go out of your way to act things out literally.
For example:
If they tell you to squeeze the tube before taking off the top, squeeze hard and show that nothing will come out.
If they don't describe the toothbrush, pick up the toothpaste or soap when they say "toothbrush."
If they don't tell you what to do with the brush when you put it in your mouth, try to eat it.
If they don't tell to stop twisting the silver knob, spray water all over the bathroom.
If they don't tell you what the sink looks like, go to the shower or window.

3. After you have acted out a command, prompt students with "What comes next?" or "Then what happens?" or "What do I do after this?" Emphasize the following specific language:

a. Body language -- **arm, fingers, hand, right foot, mouth.**
b. Appropriate nouns -- **toothbrush, toothpaste, teeth, water, faucet, bathroom, sink.**
c. Description -- **the small end of the white tube, the smooth part of the brush, the silver knob on the right.**
d. Action verbs - **twist, turn, pick up, brush, move, walk.**
e. Adverbs -- **next, then, now, first, second.**



4. As mistakes are acted out, have students help each other correct their commands in order to make the action work. Students must work out statements which will provide clear directions. If necessary, appoint a leader to take on the job of telling you what the whole group has decided comes next.

5. In small peer teaching groups, assign each group a simple task to teach to an alien. Possibilities might include making a bed, making a peanut butter sandwich, wrapping a present or taking a shower. Have students draw, write, or dictate the directions for their task on a chart so that the directions are clear and in proper order.

6. Have each group "perform" each task for the other groups. If, as the tasks are acted out, problems appear, have the whole group help rewrite the directions.

Materials: Chart paper and marker.
Paper and pencil.
Alien Costume, if desired (we used "deelie boppers," and a lightning-bolt tie; use your imagination and whatever materials you might find around the house).
Toothbrush and toothpaste (optional)

Evaluation:

Observe the sequence and clarity of directions used in performance by each small group.

Extensions:

1. Keep charts of directions and have students illustrate the activities accomplished by their own "alien."

2. From the directions dictated, give students strips which are out of order and ask students to put them in proper sequence. Have students illustrate the outcome of the activity before and after resequencing.

3. Play "The Alien" at different times when you want students to follow specific directions. Before lunch, have students tell the alien how to go through the cafeteria line. After lunch, have students tell the alien how to clean up. Before recess, have students tell the alien how to play kickball. Before going home, have students tell the alien how to pack his/her books or papers.

4. Have groups of students develop directions for a simple game and then have them teach it to younger students.

5. For Homefun, discuss activities which only occur in the classroom, e.g., library book checkout, morning calendar check or gerbil feeding. Ask students to try to teach their parents one of these activities using the directions they have worked out. Have parents choose a home job to teach their child through verbal instructions. Create a simple evaluation checklist to have parents describe the effectiveness of the teaching. For limited English-speaking parents, a picture checklist with happy and sad faces might be used.

6. Have students create "Rube Goldberg's" (complex machines designed to perform simple tasks) and list in proper sequence the steps it takes to complete the task. See the example below, created by a student.

How To Get A Warm Towel
By Barbara Kramer

Step 1: While rinsing off in your shower, pull the string at the side of your shower stall. This will cause the end of a small stick to go up and tilt the large shelf holding baseballs.

Step 2: The first baseball will fall through the hole in the center of the shelf and drop onto the rubber band below. The second baseball will roll toward the cabinet.

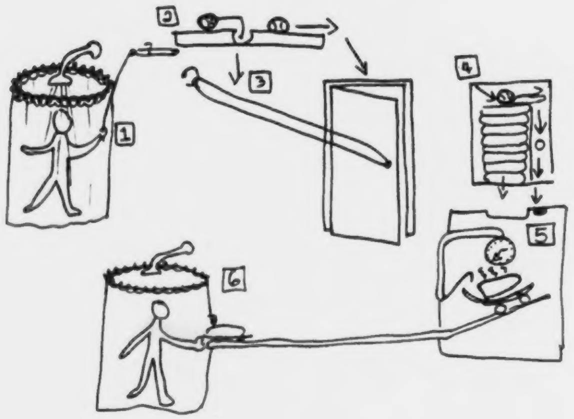
Step 3: When the first baseball bounces onto the rubber band it will pull the door of the cabinet open.

Step 4: The second baseball will then fall onto the stack of towels inside the cabinet. This will cause the bottom one to fall through into the "Automatic Towel Warmer" and onto a skateboard. The baseball will continue rolling into the tube at the side of the towels.

Step 5: The baseball will fall onto the "ON" button and the "Automatic Towel Warmer" will turn on. As the temperature rises, the needle of the gauge moves to 120 degrees. At this point the needle hits a switch which stretches a rubber band that opens the door to the "Automatic Towel Warmer." This allows the warm towel to roll out on the skateboard.

Step 6: The warm towel rolls across the plank and rings the bell at the side of the shower stall. You may turn off the water and reach right outside the curtain for a nice, warm towel.

How to Get a Warm Towel



5. THE PROGRAMMED ROBOT

Turning students into robots to get to the cafeteria or to exercise at PE is an easy way to manage a group! If your students have not had much experience sequencing or following pictorial directions, you should divide this activity into several smaller, sequenced lessons.

Procedures:

Large group, teacher directed
Small groups, teacher available

1. Gather the students together in a large group. Say that you need help to "get in shape." Explain that you think exercise is the only way to make this happen, but you're just too tired after a long day at school to do any exercises. Since they thought up fantasy robots to do special things for them, you want them to help you develop a program for an exercise robot.

2. Ask for a volunteer to act as the first "robot." Display the first cardboard exercise card and tell the student that as soon as you turn him/her on, he/she must do exactly as the picture shows. The student performs a "jumping jack." Ask the students if you appear any more fit. Say that perhaps you need to do another exercise to become fit. In front of the first picture, place an exercise card depicting "toe touching." Ask the students how you can have the robot know which exercise to do first. They should tell you to number the exercises. Put a large 1 or 2 by each picture. Now ask for another volunteer robot to follow the first two steps in your program.

3. Continue this process until the students have helped you create a program that contains several exercises. Display smaller numbers with exercise cards in order to show the number of repetitions. Guide students to repeat first, second, third, etc., and how many times each exercise is done. Have students change the order of the exercises and the number of repetitions as they become a group of exercise robots for you. Reinforce the terms -- **toe touching, jumping jack, side bends, calf stretches, hops, jumps,** as well as the cardinal and ordinal numbers.

4. At a center, have students create "action robots" by following the directions on the blackline master on page 1-14. Display a sample finished product that you have created. Help students experiment with folding strips to show bends in elbows, knees, waist, ankles and wrists.

5. Display "action robots" and have students continue to create different programs for each other to follow by combining several robots and the number cards.

Evaluation:

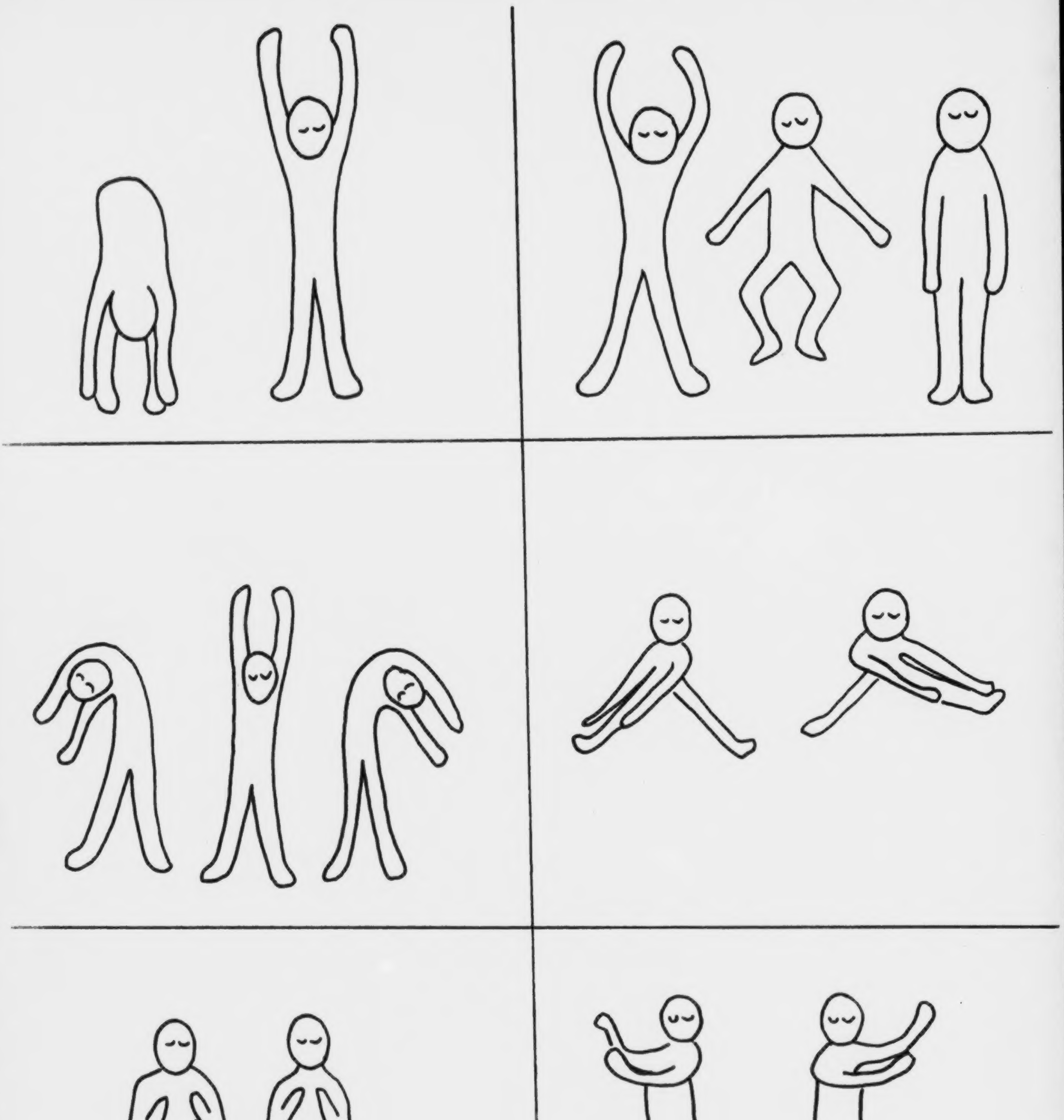
Observe how students follow pictorial and numerical directions given in various programs. You may choose to use a checklist.

Extensions:

1. In small peer-teaching groups have students design their own "programs" for robot functions, such as making clay shapes in a particular pattern, building a pattern block "train," building a house of blocks, ringing different bells in a sequence, playing different instruments in a sequence, creating different tunes with a sequence of notes, ordering things, completing a puzzle, or making designs. Each step in the sequence should be on a separate piece of paper. If, for instance, two circles are needed to make a pattern, then the number 2 should be put on the step showing a circle.

2. Use sequenced pictures in a variety of ways in your classroom -- to give directions at learning centers, to play instruments at music time, to build patterns with attribute blocks, numbers or letters, or to create dances.

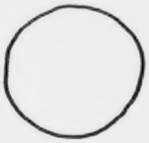
Materials: Cardboard drawings of exercises (see blackline master, p. 1-14).
Large ordinal numbers to show sequence: first through seventh (Use ordinal number words if your students are beginning to read them, if not use numerals).
Small numbers to show repetitions: 7 of each, 1, 2, and 3.
Large paper clips, chalk tray, pocket chart, or other means of display.
"Action Robot" blackline master (p. 1-15), cut up and mounted on cards.
Construction paper circles and strips of three different lengths and colors.
Glue.



1-14

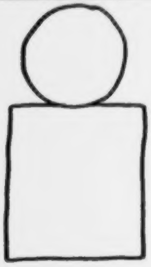
How to Make a Robot

1



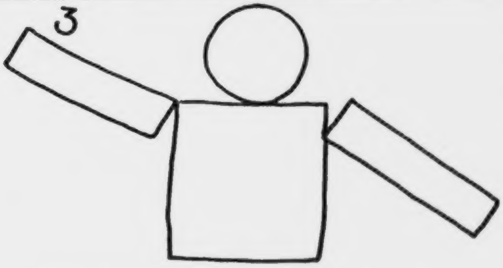
Pick 1 blue circle for the robot's head.

2



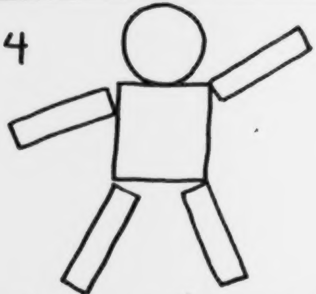
Pick 1 green rectangle for the robot's body.

3



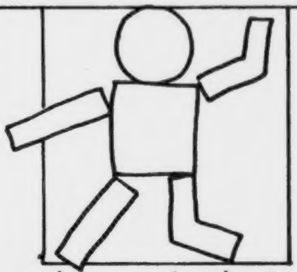
Pick 2 red rectangles for the robot's arms.

4



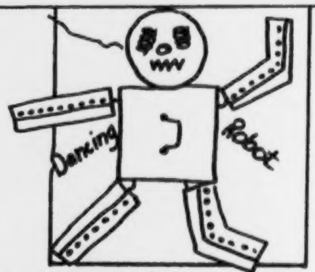
Pick 2 yellow rectangles for the robot's legs.

5



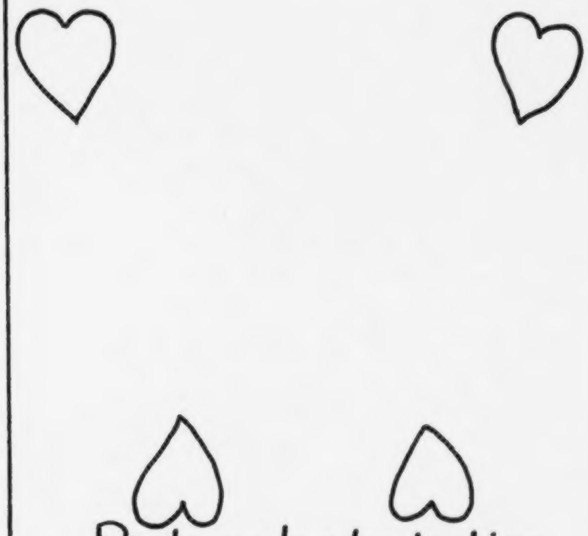
Glue the robot to a sheet of paper.

6

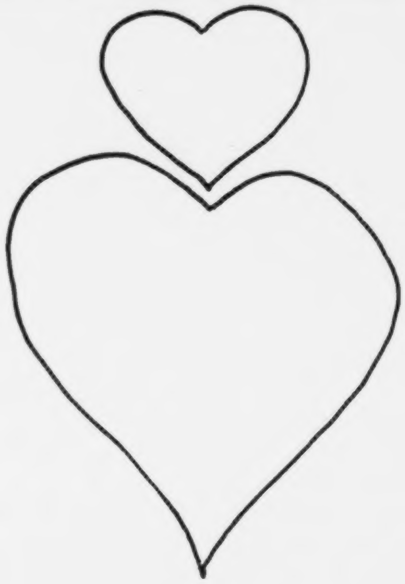


Use markers to finish the robot.

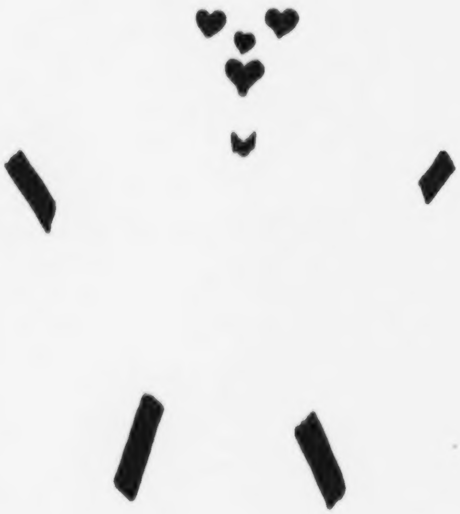
Valentine Robot



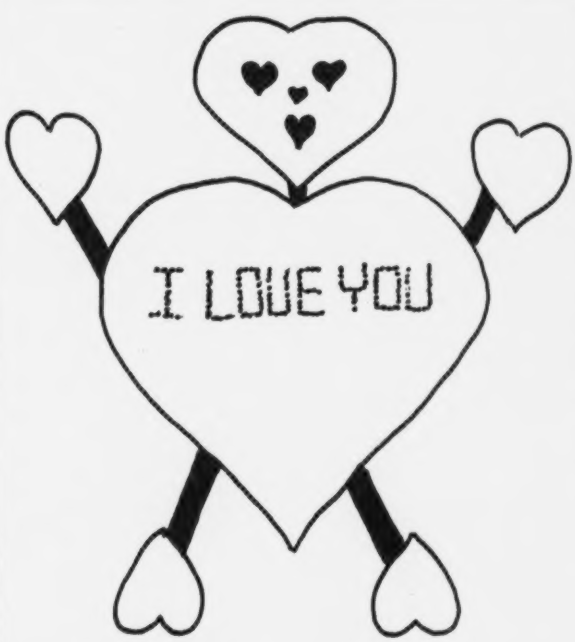
Pink robot station



Red robot station



Black robot station



Finished robot

6. THE INDUSTRIALIZED ROBOT

Be prepared for human error in your young robots. Remember that since robots do only what they are programmed to do, being a robot can be fun for only a little while.

Procedures:

Small groups

1. Explain to a small group of children that today each of them is going to be a robot in a manufacturing plant. Direct students to a long table and seat or stand them at individual work stations. At each station place an instruction prototype for each individual task within the design. "Program" each robot to do its specified task, and to pass the product to the next robot. Decide how many finished products your plant is scheduled to complete. Three products usually gets the point across for young students; five might be more appropriate for more dexterous older students. Have the appropriate number of "manufacturing supplies" at each work station. The last robot work station should include a box for storing the "product" and a paper and pencil for recording each finished "product." The sample, on page 1-16, gives instructions for creating a product, a "Valentine Robot." You could also use a block construction or a pattern with manipulatives.

2. Tell the students that their plant is scheduled to produce ________ finished "products." Remind students that each robot has its job and is programmed only to do this job. One robot never tries to help the next robot or urge the robot in front of it to go faster. Explain that after each robot finishes its job, it passes the unfinished "product" down to the next robot. This must continue until the appropriate number of pictures is completed.

3. During the lesson, reinforce the use of sequence words -- **first, next, last** -- and factory vocabulary-- **assembly line, job, product, manufacture, work, schedule, task, plant, supplies.**

4. After turning your robots into students again, have them discuss and dictate, or write individually, how they felt about the experience. How did they like:

Having to do only what he/she was "programmed" to do.

Not knowing what the finished product would look like.

Not having any input about the task he/she had to complete.

Performing only when it was his/her turn.

Being dependent on other "robots" to complete assignments.

Evaluation:

Observe how students follow directions. Observe student contributions to discussion. Study language use in students' written work.

Extensions:

1. Have students create designs for assembly line products for other "robots" to make. Folded paper hats or other origami creations are excellent choices.

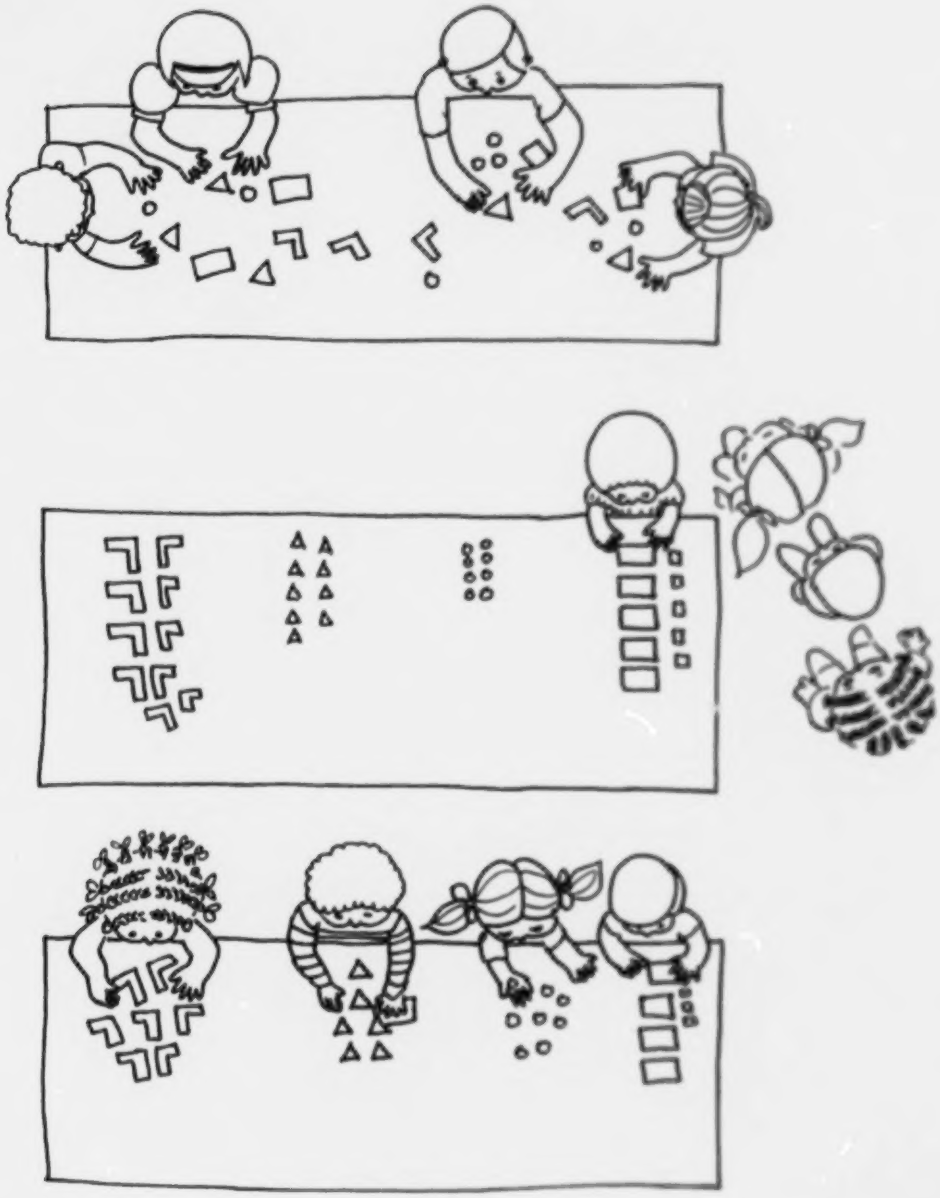
2. Create a classroom list of jobs that students believe assembly line robots might have.

3. Read Jane Thayer's *Applebaums Have a Robot* or other robot stories and/or have students write stories about a day in the life of an assembly line robot. Have students give the robot thoughts and feelings. See the reference list for other appropriate student books.

4. For Homefun, have students survey their parents about jobs in the home they wish a robot could perform. Have students break these jobs into small tasks to decide which of these could be performed in an assembly line fashion, and and which could not.

Materials: Several simple picture patterns (see blackline master sample).
Materials enough to copy and complete several of these patterns.
Stickers (optional).

ROBOT RELAY



7. ROBOT RELAY

Follow your instincts about this activity. Only you can decide how much benefit your students are able derive from the experience. The lesson can be applied at a variety of levels. Younger students might just want to have relay races and build "products," while older students might become embroiled in a discussion about robots taking over the world. Remind students that the competition is between methods of manufacture rather than between students.

Procedures:

Small groups

1. "Robot Relay" is a game which allows students to demonstrate the possible benefits of robot assembly line manufacturing. Prior to the lesson, design and create a "product" for the game from available building materials. Task cards for making a sample "product," a daffodil, are attached. You may wish to create more simple or more complex items depending on your students' abilities. You might choose to make a product with a practical use, e.g., a decoration for the class. Remember that the product must be easily assembled using simple steps in sequence. You must also create task cards which show the steps that need to be completed at each work station and must provide enough materials with which to complete the task three times.

2. There will be 3 teams of 3-5 people each, depending on the number of students in your class, and the number of steps your task requires.

Team 1: Individual Job

The first team will sit at a table on which has been placed a box containing all the pieces necessary to build three to five "products." Each team member will build one "product" by looking at the prototype.

Team 2: Station Job

The second team will line up at a table at which the sets of materials for each task have been laid out at sequenced work stations. The first student will perform the task at Work Station #1 and when he/she moves on to Work Station #2, the second student moves to Work Station #1. This continues until each student has gone down the line and created a finished product by following the task cards in sequence.

Team 3: Assembly Line

The third team will be made of specific function "robots." Each robot will be assigned a work station and will perform only that task. As the first robot finishes its task, it passes the unfinished "product" to the next robot and begins a new "product." This continues until the robots have created the specified number of "products."

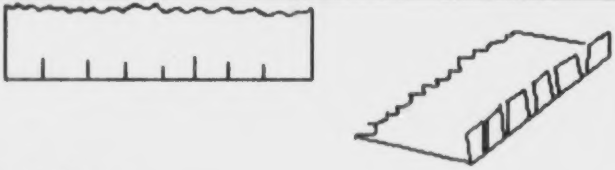
3. Call the students together and explain that the president of the manufacturing plant is trying to see what sort of system she should employ in her plant. In order to test the systems she would like three teams of workers and robots to compete so that she can determine which team is the most efficient in building her products. Show the students the prototype of the "product" they are creating.

4. Divide the students into the above teams and settings. Be sure to explain that the workers are expected to do their own tasks and that the robots work only on the task for which they have been programmed.

5. You or another student should serve as timer and tally person to keep track of time and number of "products" manufactured on the record chart (see example).

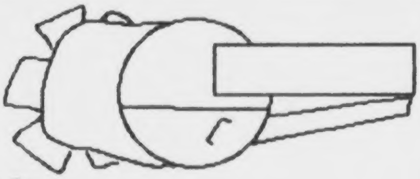
Materials: Legos, blocks, tinkertoys, pipe cleaners or other building materials -- enough to create at least 9 of the products designed.
"Product" created from one of the above materials.
Task cards for work stations to recreate the "product" with the building materials (See page 1-20).
Record-keeping chart (See page 1-21).

1



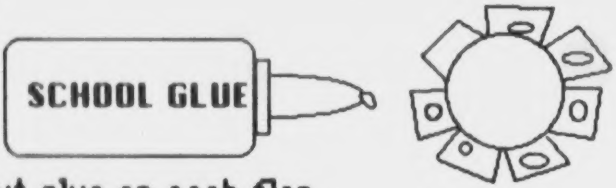
Fold up flaps

2



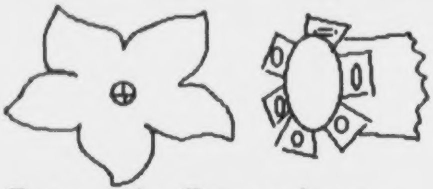
Staple into a circle

3



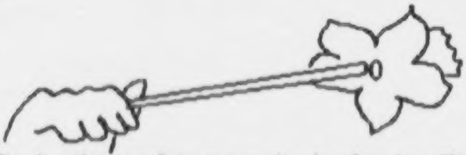
Put glue on each flap

4



Paste flaps onto flower base

5



Put pipe cleaner in hole in flower

6. During the lesson, reinforce the use of words of sequence, e.g., **first, next, last,** and factory vocabulary, e.g., **assembly line, job, product, manufacture, work, schedule, task, plant, supplies.**

7. After completing the task, students should discuss what happened and why they think it happened. Create and discuss lists of:

Which line did best/worst?
Which was easiest/hardest?
Which was most/least fun?

8. The following discussion should be used for more sophisticated students:

Many factors will enter into the final outcome of the relay. More important than the winner is the discussion that follows. Some sample points to bring out include:

What affected the outcome of the race? Which was the most important? Why?

What was the outcome you expected?

How would an increase in the number of "products" affect the outcome of the race?

Should the time it took to set up the work stations be considered in the final outcome?

What do you think about the cost of robots in comparison to human salaries?

Are humans still needed in the factory? As many as if there were no robots? For what type positions would humans be hired?

In large group dictation, or as peer group assignments which will be discussed at a later time, have students create lists of the pros and cons of industrialized robots.

Evaluation:

Observe language and ideas supported in discussion and written assignments.

Extensions:

1. Graph manufacturing method results.

2. Have students design a "product" and work station task cards for building it. At a center, set out materials so that others may manufacture these "products."

3. Have students write about their experiences in the "manufacturing plant."

4. Have students build a "product" and challenge other students to copy it exactly.

5. Have student peer groups direct the building of a "product" by giving only verbal directions to their teammates. Have them compare the difficulty levels of following verbal and pictorial directions.

Robot Relay Record Chart

Time To Complete	Individual	Station	Assembly Line
1 Product			
2 Products			
3 Products			
4 Products			
5 Products			
Average Time/Product			

8. ROBOTS AT WORK

Preparation for a field trip is paramount to its success. During the trip, play up the moment. You'll be able to experience the excitement and spontaneity of your students. We've experienced situations where the president of a company carried one of the younger students on the tour and gave insights no other tour guide could provide. Later, the experience can become such a powerful motivator that you will be able to build a myriad of extension activities upon it.

Procedures:

Large group,teacher directed
Individual, teacher available

Preparing for the trip

1. Arrange for a trip to a manufacturing plant in your vicinity. Many plants have have tours for students. Try to arrange your scheduled trip so that students will be allowed to speak to at least one or two people who work with robots. We have arranged several trips so that students could eat lunch with the employees. Conversation with children can be a pleasant break from work.

2. Through the use of pictures and books, spark student discussion about various manufacturing methods. Have students talk about differences and similarities. Ask them to compare their previous "assembly line" experience with what they see in the pictures or hear in the stories.

3. Tell the students a little bit about the manufacturing plant they are going to visit. Ask them to visualize what they think it will look like. Have them illustrate their predictions.

4. In a large group, help students prepare interview questions for people at the plant. You might assign one or two questions for each student to answer on the trip. The complexity of the questions should depend on the age and proficiency of your students.

On the trip

5. Be spontaneous. Use every opportunity possible to reinforce names and functions of the machinery. Use job vocabulary, e.g., **assembly line**, **job**, **product**, **manufacture**, **work**, **schedule**, **task**, **plant**, **supplies**, **conveyor belt**, **machinery**. Help students focus on those aspects which you want to emphasize, and then allow them to enjoy the experience itself. Tell them to look carefully so that they can draw what they have seen when they return to the classroom.

6. Use your tour guide for both structured and unstructured interviews.

After the trip

7. As soon as possible (even on the bus trip home), have students begin illustrating their impressions of the plant. Circulate through the classroom and ask questions as students draw. Have students dictate names of some of the machinery or have them label different areas of the plant. Ask them to describe their drawings so that they can tell you the functions of the machines they are illustrating.

8. Display the students' illustrations and discuss them. Bring out the prediction illustrations and have students compare the real event with what they had expected.

9. Have students answer verbally a series of questions that focus on superlatives of the trip, e.g., best, worst, funniest, biggest, fastest, most fantastic. These can be written down and used in a group letter to thank the company for its hospitality. For older or more proficient students, this activity might serve as a warm-up for writing individual letters of thanks.

Materials: Study pictures of a variety of manufacturing plants. These pictures should encompass both old and new manufacturing methods so that students can see changes that have taken place. Leonard Fisher's *The Factories* is an excellent resource. Old encyclopedias will have illustrations of old manufacturing methods, and new encyclopedias will have illustrations of modern ones.

Evaluation:

Teacher and students can compare illustrated predictions made prior to the visit with those done after the visit. Look for variety and complexity of language used in labeling drawings.

Extensions:

1. Students can act out the manufacturing process. Some students can be robots and others can be human programmers.

2. Students can "create" the kind of robots they saw in the manufacturing plant in two- or three-dimensional works.

3. Individual students can decide on products they wish to manufacture. On graph paper each student should design a plant to manufacture a product, including robots that would perform specific tasks.

4. Invite an industrial robot specialist to talk to your class. Have students take him/her on a school tour to see if there are ways to use the robot technology there. Ask some of the questions that came up when playing "Industrialized Robot" or "Robot Relay."

5. Invite the tour guide or your field trip liaison to visit your school. Have the students prepare a tour of the facility for them.

ACE MANUFACTURING

RESOURCES

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HIT THE JACKPOT:
AN INTRODUCTION TO DATA BASE MANAGEMENT

by
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Unit 2: Grades 4 - 6

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HIT THE JACKPOT

AN INTRODUCTION TO DATA BASE MANAGEMENT

Computers are highly motivating across cultures and can be used to teach a multitude of problem-solving and language objectives. The underlying basis of a thoughtful overall school curriculum should be to teach students to take an active role in their society. The use of computers as "real world" problem-solving tools should be available to all students. Because access to computers for classroom use may be difficult to obtain, this unit is designed to teach computer concepts with or without a computer.

This unit is based on the premise that computer science concepts should be taught within the context of the school curriculum rather than taught in isolation in "Computer Literacy" courses. In the following data base unit, both math and language objectives are achieved by solving problems using computer concepts. Because the concepts and vocabulary of computer science are usually unfamiliar to both English-speaking and non-English speaking students this unit may help to bridge the culture and language gap between these groups.

The creation of a data base, which is an organized collection of information, teaches students to organize and manipulate specific lists of numbers, and to use the data base they have created to solve a variety of logical problems. In manipulating the data base, students must understand and apply the following mathematical terms and concepts: set theory; relations such as "equal to" or "greater than;" whole numbers; counting numbers; even and odd numbers; multiples and factors; prime and composite numbers; squares, cubes, and their roots; and palindromes and symmetry.

Because some of these concepts and terms will be unfamiliar to students, an appendix follows the data base lessons. This appendix includes a glossary of terms, center activities for reinforcing mathematical concepts and lists of sample logic problems to be solved.

In all of the unit activities, the teacher introduces the concepts to the whole class, and then reinforces and extends these concepts in small groups, in the learning center, and through Homefun activities. Lessons encompass hands-on manipulation of objects and numbers, debate, dramatic expression, graphing and, if computers are available, the use of computer data base software.

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JACKPOT

HIT THE JACKPOT
OBJECTIVES

Activities **Objectives** **Unit 2 / Grades 4-6**

1	2	3	4	5	6	7	8	9	MATHEMATICS
		●	●						Interprets and uses ordinal numbers to 12th (GBC 4).*
	●	●	●	●	●	●	●	●	Compares and orders whole numbers and fractions (GBC 4,5,6).
	●	●	●	●	●	●	●	●	Adds, subtracts, multiplies, and divides with whole numbers (GBC 4,5,6).
			●	●	●	●	●	●	Selects appropriate operation for a given problem situation (GBC 4,5,6).
		●		●	●	●	●	●	Plans the solution for simple word/logic problems with one, two, or more operations (GBC 4,5,6).
	●	●	●	●	●	●	●	●	Uses deductive reasoning in manipulating organized lists (GBC 4,5,6).
	●	●		●	●	●	●	●	Determines a missing number from a set given a rule (GBC 4,5,6).
		●		●	●	●	●	●	Identifies place value for a given digit in a number (GBC 4).
		●	●	●	●	●	●	●	Collects quantitative data by measuring and reading charts and graphs (GBC 5,6).

1	2	3	4	5	6	7	8	9	COMPUTER SCIENCE
		●	●	●	●	●	●	●	Demonstrates skill in processing information using a data base.
●	●		●	●	●	●			Demonstrates an understanding of the meaning of data base terms.
			●		●		●		Creates a data base using sets of numbers. Collects and writes information in a data base.
			●						Determines data for extending a data base.
				●		●		●	Demonstrates skill using the data base to search records to solve systematically logic problems of varying degrees of difficulty.
				●		●		●	Determines the correct category or field on which to search records in order to solve a problem with a data base.
				●		●		●	Determines the best conditional relation to use in a record search in order to solve a problem with a data base.
				●		●		●	Decides on comparison information for a record search in order to solve a problem with a data base.
							●	●	Demonstrates an understanding of the specialized uses of data base software.
●	●						●	●	Demonstrates an understanding of the meaning of data base terms specific to data base software.
							●	●	Using data base software, creates a data base using sets of numbers, collects and writes information in a data base, searches records systematically to solve logic problems of varying degrees of difficulty.

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HIT THE JACKPOT
OBJECTIVES

Activities **Objectives** Unit 2 / Grades 4-6

1	2	3	4	5	6	7	8	9	**LANGUAGE**
●	●	●	●	●	●	●	●	●	Participates in oral activities as an active listener in the environment (GBC 4,5,6).
●	●	●	●	●	●	●	●	●	Listens and responds to language presented orally for the purpose of gathering information and following directions of one or multi parts, making judgements, recognizing cause and effect relationships, recognizing sequence of events, drawing conclusions, and making comparisons (GBC 4,5,6).
●			●	●		●	●	●	Defines and interprets a word by example, description, and through comparison and contrast (GBC 4,5,6).
●			●	●		●		●	Develops meanings for new words through experiences (GBC 4,5,6).
●									Classifies words in the context of everyday situations (GBC 4).
	●			●		●		●	Interprets syntactic relationships in the context of both academic and everyday situations (GBC 4,5,6).
●		●		●	●	●	●	●	Uses conventional language patterns (GBC 4,5,6).
	●			●		●	●	●	Demonstrates a variety of ways to communicate and describes experiences clearly including dramatic, oral, written and artistic presentations (GBC 4,5,6).
●	●	●	●	●	●	●	●	●	Understands and uses a functional vocabulary related to the environment (GBC 4,5,6).
●	●	●	●	●		●	●	●	Uses elaborated language to describe experiences and environment (GBC 4,5,6).
		●	●	●	●	●	●	●	Interprets and follows written instructions and labeling information (GBC 4,5,6).

1	2	3	4	5	6	7	8	9	**SOCIAL STUDIES**
●			●	●	●	●	●	●	Collects, organizes, writes, and interprets information in tables (GBC 4,5,6).
	●	●	●	●	●	●	●	●	Recognizes the relevance of data (GBC 4,5,6).
			●		●		●		Uses resource materials and tools including encyclopedias, mathematical dictionaries, and a variety of calculators (GBC 4,5,6).
●	●	●	●	●	●	●	●	●	Works effectively in groups with peers and adults.

*Georgia Basic Curriculum Objective for given grade level(s).

1. YOU BET YOUR LIFE

You Bet Your Life can be played with any lesson throughout this unit in order to reinforce math or data base vocabulary. The game can be varied and continued throughout the year to build vocabulary.

Procedures

Large group, teacher directed
Small groups
Center activity

1. Have you ever seen Groucho Marx, who hosted "You Bet Your Life?" During the course of the show there was always a Magic Word known to Groucho's "behind the scene" co-worker. If, in the course of playing the game, a player said the Magic Word, a duck puppet would drop down, bells would ring, music would play and the contestant would win money. Then the word would change and play would continue.

2. Don your Groucho costume and explain to students that as they work throughout the day, you will be listening to hear if they use the new words they have been learning. Choose a list of "Magic Words" for the day, and write them on a chart.

3. Assign a student to be Groucho's assistant and listen out for the "Magic Word" at the top of the list. When it is used, the assistant plays the recording or toots a horn and waves the duck puppet to catch the attention of the class. Then he/she writes the Magic Word on the class graph next to the name of the student who said it. The next word on the list becomes the new "Magic Word" and play continues.

4. Refer to the graph frequently to reinforce important terminology and motivate students to use new language.

Evaluation:

Use the graph to evaluate student progress in learning and using vocabulary.

Materials:
Groucho Marx glasses, nose and moustache.
Lists of "Magic Words" from various lessons.
Magic "Duck" puppet or doll.
Tape recording of bells, buzzers, and musical phrase (optional).
Class roll graph (see example).

Duck Words

Name						

2. TWENTY QUESTIONS

Twenty Questions is an old favorite of many teachers. The game fits easily into these lessons and reinforces both math terminology and problem solving strategies.

Procedures

Large group, teacher directed
Small groups

1. Secretly determine a number such as 16 and say: "I'm thinking of a number." Students must try to guess the number by first naming possible sets to which the number belongs, such as: Even, Multiple of 4, Square and Square Root. When the students guess a set the teacher must answer only "yes" or "no." Then, from the answers given, students may try to name the number.

2. Students may ask up to, but not more than, 15 questions about the mystery number and may make 5 direct guesses. Questions must be phrased so that they can be answered only by "yes" or "no." Questions should also progress from general to specific. For instance, "Is the number a multiple of 5?" should be one of the first questions, whereas, "Is the number 15?" should be one of the last.

3. As your students progress through this unit, their expanding language and mathematical skills should allow them to take over the leadership of this game.

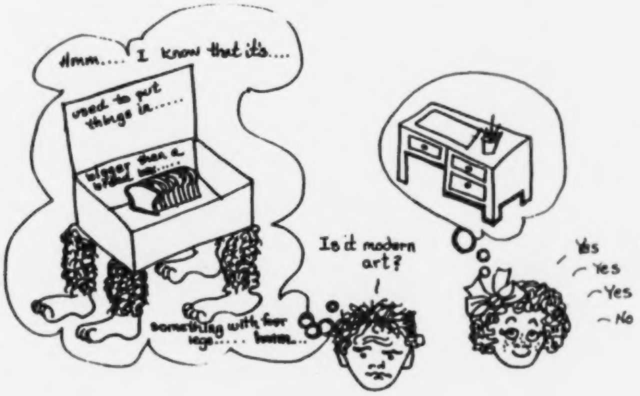
Evaluation:

Observe the level and quantity of questions asked by students, as well as their ability to correctly guess the answers, and their assumption of leadership roles.

Extension:

By changing the types of questions, this game can also be adapted to computer terminology and usage. For example, begin a game with "I'm a part of a data base," and students can ask questions to determine what you are. The one essential rule -- asking questions that can be answered only by a "yes" or "no" -- should still apply.

Materials: None


Hmm.... I know that it's....
used to put things in......
bigger than a bread box.....
something with four legs..... hmmm...
Is it modern art?
Yes
Yes
Yes
No

3. THE DILEMMA OF THE BOXES

Before beginning this lesson, remind students of the number families that are subsets of the set of whole numbers. Set concepts such as "divisible by" or "even" or "square" are very important to this unit. You and your students may wish to read the book *Number Families* by Jane J. Srivastava.

Procedures:

Large group, teacher directed
Center activity

1. On the chalkboard write this pattern: 1, 9, 25, 49. Ask your students to add three more numbers to the pattern. Ask them to explain the logic they used to generate these numbers and then as a group to decide on a name for the pattern, "square numbers that are odd" or "uneven squares." Ask students to think of more sets of numbers that are named by more than one attribute, such as "even multiples of five" or "numbers greater than 10 that are odd and multiples of three."

2. The goal of the box activity is for students to use classification to solve problems. Tell students that they are going to use the same idea they just employed to solve "The Dilemma of the Boxes." Help students define the term "dilemma" if necessary.

3. Before beginning this problem, set up your classroom: Label four sets of seven boxes or cards in the following manner:

A. 1112, 1324, 1568, 1030, 1998,1002, 1754
B. 9, 49, 81, 169, 9, 25, 121
C. 105, 195, 150, 135, 115, 185, 120
D. 17, 19, 29, 31, 2, 3, 11

4. Place the first four boxes or cards of set A on the first shelf, set B on the second and so on. In each box of set A place one poker chip. If you are using cards and a pocket chart, tape chips to the backs of cards. All the chips in set A should be the same color. Put chips in each box of the remaining sets, using a different color chip for each set. This will make the problem self-checking. Keeping the chips hidden, mix up the last three boxes or cards of each set and pile them all on the floor.

5. Prizes of all kinds -- stickers, plastic charms, free reinforcers (such as a chance to tell the class a joke or five minutes of library time) -- can be used as consequences for correctly shelving the boxes. Prizes can be determined by coordinating them with the chip colors.

6. Show your students the dilemma. Tell a story about the boxes, e.g., you are a shoe salesperson and the store was so busy you didn't have time to put the shoes away. Now they are all mixed up. You tried to put the boxes on your shelves, but have forgotten how the shelves are organized. You need help remembering so that these other boxes can be shelved.

7. Have students look at the numbers on the shelved boxes in order to determine the set(s) to which those boxes belong. Have students sort and shelve the mixed up boxes according to their set names.

The sets of boxes that go on each shelf are:

Shelf A. Even numbers > 1000 and < 2000
Shelf B. Odd, square numbers
Shelf C. Multiples of five > 100 and < 200
Shelf D. Prime numbers

Materials:

Bookcase, shelves, or pocket chart with at least four levels.
Boxes that fit into your bookcase, shelf or cards for your pocketchart -- at least four per level.
Chips or squares of paper for each box in at least four different colors -- these colors are matched to prizes or rewards.

8. While solving the problem, emphasize ordinal numbers and the following mathematical terms: **even/odd, greater than/less than, multiples, squares, primes/composites, sets, and ones, tens, hundreds, thousands.**

9. Students can find out if their boxes are correctly shelved by checking to see that all the boxes on each shelf contain the same color chip.

10. When you are finished with the problem, tell your students that they will be "paid" for their work. Then jumble the boxes in a pile, allow students to randomly choose a box. His/Her "paycheck" is then matched to the rewards you have decided upon. Change the numbers on the boxes and repeat this problem as a center activity.

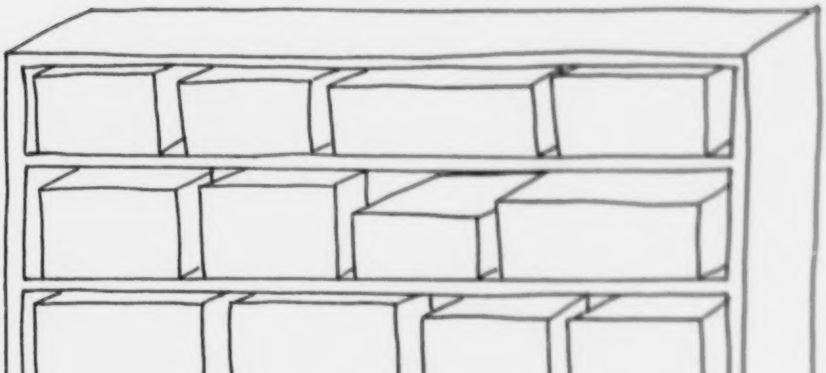
Evaluation:

Observe the strategies that students use to analyze and determine sets.

Extensions:

1. Change the number labels on your boxes or cards so that students can play this problem as many times as they like in a center or in small groups. Prepare sheets with box problems for Homefun or for use in the learning center to reinforce the use of sets to solve problems.

2. Set up a "Classification Center." Provide groups of items for students to sort into categories according to given attributes. Place several items in a bag that "belong" together because of a particular characteristic and include one which does not "belong." Have students decide on a classification system for a group of items and challenge their classmates to come up with the attribute(s) upon which the system is based.



DATA BASE BULLETIN BOARD: This bulletin board should be at least 6 feet x 4 feet. Use colored paper for the overall background. Alternate two or three different pastel shades of paper for the columns. Use a dark color (black or dark blue) for the numbers, lettering, and lines. This data base skeleton can be made into a transparency for use on the overhead projector, and into individual student copies.

NUMBER DATA BASE

WH#	EVEN	DIV3	DIV4	DIV5	DIV7	DIV8	DIV9	PRIME	SQU	#SQU	CU	#CU	PALI

4. ORGANIZING DATA

This lesson plan introduces the concept of data bases and data base components. An exciting enhancement to this lesson might be a field trip to a bank or other business that uses computer data bases. Ask for a demonstration of the fields and records that the business uses in its work.

Procedures:

Large group, teacher directed
Small groups

1. Remind students that to solve the problem from the previous day they needed to consider specific lists of numbers defined by patterns such as "divisible by 5" or "square numbers." Tell them that the large table on the wall is a data base template skeleton in which they are going to arrange numbers and information about numbers in order to solve some interesting problems with ease.

2. Indicating the column marked "Wh#," tell students that this is a "field" called "whole numbers that are less than 26." Help students who are familiar with the term "field" see that it has a new mathematical definition. Write "17" on a card and place it on the first row of the column saying, "This is a data entry in the field 'whole numbers less than 26.'" Ask a student to give you another data entry that would fit into this field. Write it on a card and place it in the second row of the field. Continue in this manner, emphasizing the words "data entry" and "field."

3. As you get toward the end of your stack of cards, students will find it more difficult to come up with data entries that have not been used. Suggest that arranging the data entries in an orderly manner would be helpful. Let them rearrange those numbers already entered, and then finish filling in the field, with 1 in the first box and 26 in the last.

4. Tell students that this data base has other fields besides "Wh#." Ask them to look across the top of the data base and name them. Data entries across a row all belong together and are called a "record." Each record has data entries in every field.

5. Ask students to help you enter the data for the record "10." Say, "The first field is 'even.' Does the number 10 belong to the set of even numbers?" The students will tell you "yes" and then you will place a "yes" card in the correct data entry space. Say, "The next field is 'divisible by 3.' Does 10 belong to the set of numbers which are divisible by 3?" Your students will say "no" and then you will place a "no" card in the correct data entry space. Continue in this manner until the entire record is filled in. Emphasize the words "record," "data entry," and "field."

6. "Yes" and "No" are the entries for all data except in the fields called "Squ# (Number Squared)" and "#Cube (Number Cubed)." In these fields place the correct numerals, such as "100" and "1000" for the record "10."

7. Work through the record "0" in the same way, but let the students fill in the entries across the row.

8. At this point your class can fill in the remaining records of the data base. Depending on the size of your group and their abilities, assign the completion of the remaining records to individuals or groups.

9. Use the following terms for "You Bet Your Life" during the week: **field**, **record**, **column**, **row**, **data base**.

Evaluation:

Observe students for the accuracy with which they fill in the data base and the number of words that appear in the "You Bet Your Life" chart.

Extensions:

1. Set up and use the "Math Center" in Appendix A.

2. A data base of the class is an interesting activity. Create a poster-sized data base chart of your class. The first field is "Name" and the other fields include interesting categories of data about your students, such as "birthdate," "country of origin," etc. Each student should fill in the record that begins with his/her name.

Materials: Bulletin Board (see sample on page 2-10).
364 small blank cards that fit the columns and rows of the data base skeleton.

5. SOLVING PROBLEMS

Often young students find answers to simple problems, but cannot explain how they arrived at these answers. The use of this data base teaches students to organize and manipulate specific lists of numbers as they develop strategies to solve a variety of logic problems.

Procedures:

Large group, teacher directed
Small groups, teacher available

1. Present your students with the following "Magical Mystery Number" problem: "I am the only 2-digit, odd, composite number less than 20."

2. Ask the students to determine the sets of organized lists needed to solve the problem. These will include (a) all 2-digit numbers; (b) all odd numbers; (c) all composite numbers; and (d) all numbers that are less than 20.

3. Of the 4 possible fields, the easiest to search is "whole number less than 20." Poster #1 lists all fields, poster #2 lists all relations, and poster #3 asks for comparison information. As you walk students through this process, from poster #1 they will choose "Wh#" as the field to search; from poster #2 they will choose "less than" as the appropriate relationship; and for poster #3 they will enter "20" as the number to be compared.

4. A student, acting as the computer, will place a red push pin to the left of each record that satisfies the sentence, "Whole Number is less than 20." There should be push pins next to the numbers 0 through 19.

5. Now walk students through the process once again to search all the red records for those that are "odd". From poster #1 they will choose "even" as the field to search; from poster #2 they will choose "is equal to" as the appropriate relationship; and for poster #3 they will enter "no" as the necessary entry.

6. A different student, searching only the red records, will place a yellow push pin to the left of each red record that satisfies the sentence, "Even equals No." There should now be push pins next to the numbers 1, 3, 5, 6, 9, 11, 13, 15, 17, and 19.

7. Now search all the red / yellow records for those that are "composite." From poster #1 choose "prime" as the field to search; from poster #2 choose "is equal to" as the appropriate relationship; and for Poster #3 enter "No" as the necessary entry.

8. A third student, searching only the red/yellow records, will place a blue push pin to the left of each red/yellow record that satisfies the sentence, "Prime equals No. " Red/yellow/blue push pins will be next to 9 and 15.

9. Tell the students that there are no more colors of push pins. It is now up to them to search the red/yellow/blue records for the answer to the problem. The fourth set is 2-digit numbers. Therefore 15 is "the only 2-digit, odd, composite number less than 20."

10. From "Tangled Problems" choose several problems that can be solved with this data base. Divide the students into small groups, pass out copies of the three problem solving posters, and assign an appropriate problem to each group. As students discuss strategies, advise and encourage them.

Materials: Push pins or dot stickers in 3 different colors, at least 25 each.
"Tangled Problems" (See Appendix D).
Record Search Posters and dittos (See sample below).

RECORD SEARCH POSTERS

#1

FIELD TO SEARCH

1. WH#
2. EVEN
3. DIV3
4. DIV4
5. DIV5
6. DIV7
7. DIV8
8. DIV9
9. SQU
10. SQU#
11. CUBE
12. CUBE#
13. PRIME
14. PALINDROME

#2

RELATIONSHIP

1. equals
2. is greater than
3. is less than
4. is not equal to
5. is blank
6. is not blank
7. contains
8. begins with
9. ends with
10. does not contain
11. does not begin with
12. does not end with

#3

COMPARISON INFORMATION

N/Y _

11. Have students reassemble to dramatize their solutions on the data base. Play "You Bet Your Life" during these dramatizations using the terms **equals, is greater than, is less than, comparison, data, even/odd, multiples, squares, sets, field, primes/composites, record, entry,** and **data base.**

Evaluation:

Observe students' solutions, strategies, and use of terms.

Extensions:

1. Send home problems the students have solved in class to try out on their families. Be sure the students are comfortable with the explanations of the solutions so that they can share them with their parents.

2. If you have created the classroom data base suggested in "Organizing Data," Extension #2, create "Who Am I?" problems using fields from the data base chart. Students will search the fields as they did above to find the person or persons who fit the mystery descriptions. Have red, yellow, and blue sticky dots available to use instead of push pins.

3. Make up a BINGO game with the data base categories. Use cards ruled off in inch square grids. Put whole numbers from the large data base in each square in random fashion. The caller names numbers to be covered by naming categories, relations, information. For example: "Under the B column, a number that is even and divisible by 5." Using the large data base as a reference students decide on the number or set of numbers that can be covered and search their card for those numbers.

6. EXPANDING THE DATA BASE

In this lesson, students increase the usefulness of their data base by completing the records for numbers to 100 and beyond. As they work together to fill out their new records, they will use a wide variety of mathematical terms and will discuss computation strategies and results.

Procedures:

Small group, teacher directed
Independent work at center

1. Divide the students into small groups of 2 to 4 each.

2. Give each group a copy of the data base template. A set of 25 whole numbers should be listed on each group's template. Group 1 should have numbers 26-50. Group 2 should have 51-75, etc. Help each group begin to fill in its data base.

3. At a math center at which there can be found manipulatives such as pebbles, cuisenaire rods, tables found in dictionaries or encyclopedias, and calculators, each group must fill in the data base for its set of numbers, just as the whole class did for the numbers 0-25.

4. When all group data bases are completed, groups should trade data bases and check to verify the accuracy of the data.

5. Give each group 26 of the large strips, each strip representing one record (or row) of the data base. On one strip the data base field titles should be written. The other strips should be filled in with the data.

6. Play "Twenty Questions" using the expanded data base.

Evaluation:

Use the data base records made by the students to evaluate students' understanding of the data base use of the properties of numbers and knowledge of unit terminology.

Extension:

In your center create a new data base chart on cars. Include fields such as **make, color, year, number of doors, roof type,** and **foreign** or **domestic**. Have students fill in the data base for the car(s) their families own. Reproduce the chart, and suggest that students keep copies in their family cars. As they travel around the neighborhood, students can fill in records on the cars they see. When students have filled in records for ten cars they can enter these new data into the class data base.

Materials: Ditto of the Data Base template.
Strips of poster board, approximately 1 inch x 22 inches, marked off into fourteen 1.25 inch sections with one 4.5 inch section at the end.

7. HIT THE JACKPOT

A classroom game show provides painless practice in using the data base to solve problems!

Procedures:

Large group, teacher directed
Small groups of 3-4

1. Prepare the class for this lesson in advance. Divide your students into several groups of three or four. Try to balance the groups by language proficiency. Have them decide upon at least three fields of a personal data base to which they all belong. From this information let each group decide upon a name for its team.

2. Have the teams introduce themselves by using three sentences that describe the set of team members, such as "All members of our team are super soccer players;" "All members of our team are taller than 4 feet;" and "The names of all members of our team begin with the first 10 letters of the alphabet."

3. Prepare the classroom before the students enter. Set the "stage" to look like a television game show in front of Bulletin Board II. At center stage place a table and chair on which sit a fancy box and the timer. Have a chalkboard or chart paper accessible to the table. Facing the table set up chairs and tables for panels of contestants composed of teams of 3 or 4 students. Each team should have a heading strip and set of Records. From "Tangled Problems" choose those which are appropriate to your students and, on separate strips of paper, write out as many problems as there are teams. Jumble them up in the box.

4. Don an appropriate "host" costume, perhaps a top hat, bow tie, or glitters and bangles, and introduce yourself as the "Magnificent Host" of "Hit the Jackpot." Call out the contestants and have members of each team introduce themselves.

5. Explain that in order to play "Hit the Jackpot," the teams must guess the identity of the Magical Mystery Number by searching the number data base. These records are located in separate stacks at each station and will be used to help contestants find the answers they seek.

6. To begin, ask Contestant Team #1 to identify the first Magical Mystery Number. Randomly choose a problem from the box and write it on the chalkboard for the contestants to see. Read the problem aloud for the "television audience."

7. Team #1 must identify, from the posters on Bulletin Board II, the three fields to search and the relations and comparison information to use with each field. Write its choices on the chartpaper.

THE GAME SHOW
GAME SHOW HOSTESS

Materials: Bulletin Board II.
Record strips 0-26.
Record and field strips from previous lesson.
"Tangled Problems."
Kitchen timer.
Chart paper or chalk board with these headings:
CATEGORY RELATION INFORMATION

8. After Team #1 has determined fields for record searching, all teams must search their data base strips for records that satisfy the first conditional sentence and place them on Bulletin Board II. Team #1 must then direct the host to mark those records which fit the second conditional sentence and delete those which do not. Repeat this process for the third conditional sentence.

9. Team #1 then has two minutes for any eye searching or calculations necessary to arrive at a final solution. Let a student set the timer and count down the final thirty seconds in 5 second intervals. At the end of team #1's searching and figuring, members must name the Magical Mystery Number.

10. As soon as Team #1 has finished, Team #2 gets its problem and the game continues until all teams have had a chance to identify a number. Prizes or awards can be determined according to your own judgment. This game can be played often with many different problems. As the teams progress, allow students to take turns playing the role of host or hostess and add "You Bet Your Life" to the game.

Evaluation:

Observe team introductions for students' use of language forms such as those used in making introductions. Observe students' discussion of problem-solving strategies, and the success of their solutions. Continue to use the "You Bet Your Life" chart to assess students' use of terms.

Extensions:

1. Send home more problems that students have solved in class to try out on their families. Be sure the students can explain the solutions to their parents.

2. Once the automobile data base is completed, questions about the cars of your community can be answered in the same way questions about numbers are answered above. Survey the group for questions, determine the fields to search and the best relation to use for the search. Create graphs of the information and/or a display to share with the rest of the school. Reports on the cars which turn up most often in the search may be included.

8. ON THE COMPUTER

This lesson is optional, and if used should be spread over a period of several days. Using it depends on easy access to computers and data base software, and on your willingness to play with the machines. Use the following procedures with the manual which goes to your software.

Procedures:

Large group, teacher directed
Small groups at computer center

1. Before beginning this lesson you should create and save a data base on your computer called "Whole Numbers" using the data and fields from the previous lessons. Following your manual, create posters of the screens and directions for creating a data base and filling in records.

2. Explain and demonstrate the commands needed to create the fields for the number data base on the computer. Pretend you are the user and let students guide you in filling in the fields on your data base poster.

3. On the chalkboard, demonstrate the computer's instructions for creating fields and for entering new records. Let the students direct you as you enter your records.

4. Having decided on the final number of your computer data base, give student teams equal sets of numbers to be entered into the "Whole Numbers" Data Base. These sets should begin where your computer data base ended.

5. Briefly review the mathematical formulae or actions needed to determine the data for the numbers on the students' lists. Let students begin working at the calculation center to fill in their data base records.

6. When this work is completed, instruct each group to determine who will perform the necessary data entry tasks at the computer. Direct the groups to create a data base file on their computers called "Whole Numbers" Data Base. These sets should begin where your computer data base ended.

Evaluation:

Check students' accuracy and independence in completing data bases, listen for their use of vocabulary and forms in conversations with peers. Notice how well they help one another in pairs and small groups.

Extension:

Ask groups of students to create folders of instructions for all the commands and screens used with your data base. These can be used with other classes or for a "sharing night" at which parents are taught about computers and data bases.

Materials: Record Search Posters (See Activity 5).
Ditto of data base table (See Activity 4).
Computers.
Data Base Software, for example:
- Appleworks for the Apple Computers
- PC Files for most PC's, Apples & Macntosh, TRS 80 & TI
- Data Manager for Commodore 64 and 128.

Check Stuart Brand's *The Whole Earth Software Catalogue* for others.
Calculation Center.

9. SOLVING PROBLEMS THE COMPUTER WAY!

The previous lesson is a prerequisite for this lesson. Students begin to see that when a great deal of data must be searched to solve a problem, the computer's ability to handle massive amounts of data with lightning speed makes it an invaluable asset.

Procedures:

Large group, teacher directed
Small groups at computer

1. Before beginning this lesson, follow your data base manual in order to arrange and clip together all of the student data bases into a large data base called "Whole Numbers."

2. Explain and demonstrate to the entire class the commands needed to search records and print reports. Assign the roles of User, CPU (Central Processing Unit), and Output to various students. Using the Data Base Posters for selecting and printing records and several record strips from the previous lessons, simulate the computer's commands and actions needed to create and print the solution to a problem. Solve several problems in this way. Play "You Bet Your Life" using as "secret words" the specific commands of your data base software.

3. Solve some of the same problems that students previously solved manually. Help students compare the amount of time that solving the problem takes manually and the time it takes using the computer.

4. At the computers, give each group a set of forms for creating reports, searching records, and printing reports. Give each group several problems to be solved. Direct each group to open the data base, load "whole numbers," and solve the problems. As teams create and print out their reports, provide assistance and encouragement.

5. Ask groups to present their problems, reports, and the steps they followed to reach their solutions. In this way they can discuss the wide variety of steps one can follow to solve a problem.

Evaluation:

Observe students' discussion, and assess their computer solutions. Note which students are willing to present group information to the class. Interview individual students who are reluctant to speak before the group to assess their understanding of the problem solving steps when using a data base.

Extensions:

1. On a bulletin board create a large crossword puzzle composed of number problems that can be solved by searching the data base. Assign parts of the puzzle to each group for solutions. As solutions are found, students can put them on the board. Groups with interlocking solutions may find that they disagree and will then have to help one another with solution steps until agreement is reached.

2. Make a ditto of a word search puzzle using the important mathematical words and field titles such as **Divisible by 5, Square Root,** or **Digit Sum.**

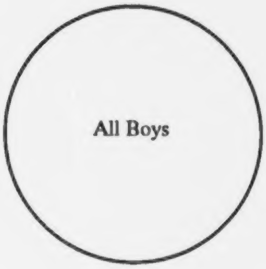
Materials: Record Search Posters (See Activity 5).
Ditto of data base table (See Activity 4).
Computers and data base software.
Completed Data Base "Whole Numbers" - 1 per computer.
Problems to be solved by the Data Base.

Hit the Jackpot
Appendices

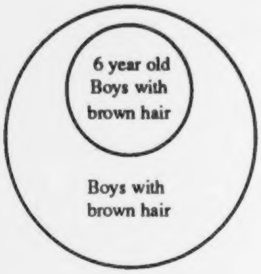
- A. The Math Center
- B. Glossary of Mathematical Terms
- C. Glossary of Data Base Terms
- D. Tangled Problems

Appendix A

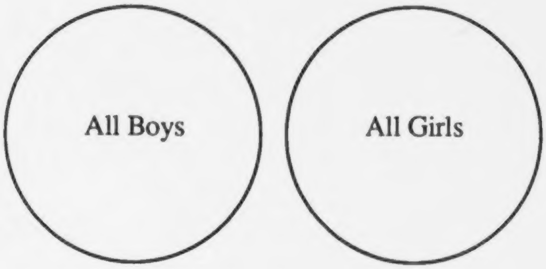
THE MATH CENTER



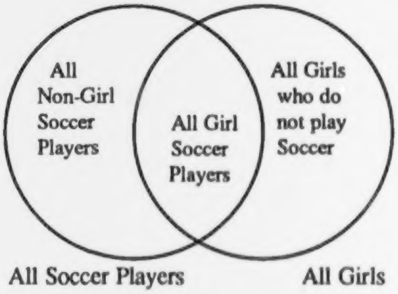
Set


6 year old Boys with brown hair
Boys with brown hair

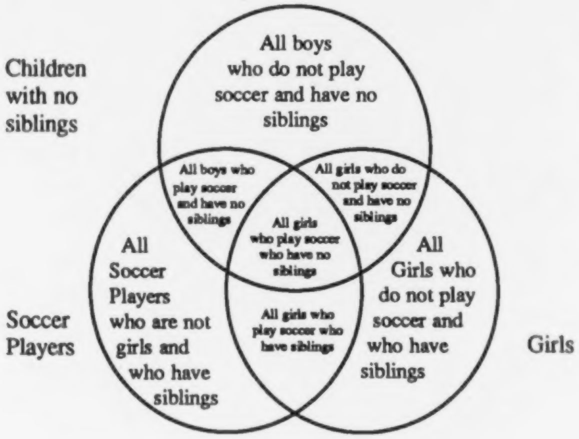
Set With Subset


All Boys
All Girls

Disjoint Sets


All Non-Girl Soccer Players
All Girl Soccer Players
All Girls who do not play Soccer
All Soccer Players
All Girls

Intersection of 2 Sets


Children with no siblings
All boys who do not play soccer and have no siblings
All boys who play soccer and have no siblings
All girls who do not play soccer and have no siblings
All girls who play soccer who have no siblings
All Soccer Players who are not girls and who have siblings
All girls who play soccer who have siblings
All Girls who do not play soccer and who have siblings
Soccer Players
Girls

Intersection of 3 Sets

THE MATH CENTER

This math center contains sample kinesthetic and visual activities for reviewing math concepts and terms that students will need as they solve problems with their data base. It should be set up before you begin your Number Data Base and left up throughout the unit. Use it for individual, small group, or whole class assignments. The manipulatives and possibilities for such a center are myriad. Feel free to adapt, or add to these ideas with activities you have used before in order to teach the necessary concepts to your students.

SET THEORY

1. **Special Sets:** Let students play with "attribute blocks," "people pieces," or groups of various objects that have attributes they can describe and place into sets.

2. **Family Circles:** Give students circle diagrams of sets, sets with subsets, disjoint sets, and intersections of two and three sets (See illustration on page 2-20). In each circle diagram, let the students draw and/or write descriptions of friends or relatives who fit into sets and subsets they have decided on. Or have students cut out pictures of people from magazines, divide them into categories of their own, and paste them into the appropriate circles.

3. **Computer Sets:** Use the computer software "Gertrude's Puzzles," "Moptown Parade," and "Moptown Hotel" by the Learning Co. for work with attributes (available for Apples, IBM PCs and compatibles and Commodores).

EVENS AND ODDS

1. **Graphing the Odds:** Give students various quantities of little objects -- buttons, coins, chips, blocks and a duplicated bar graph on which each block represents two items. By dividing these objects into sets of two, let students color the spaces on the graph. A half space shows that there is only one in the last set. Students can then determine if the number of objects is even or odd.

2. **Operations With Evens and Odds:** Let students make addition and multiplication charts for only even numbers, only odd numbers, and for even numbers on one side of the table and odd numbers on the other. Lead them to make generalizations about the patterns they find.

3. **Rules of the Game:** Create charts of numbers that have been determined odd or even. Let them discover that:

a. Counting every other number, beginning with 0, produces the set of even numbers.
b. The final digits of even numbers will always be a 0, 2, 4, 6, or 8.
c. All even numbers are multiples of 2.
d. All numbers which are not even are odd.

MULTIPLES AND FACTORS

1. **Arrays:** Use buttons, chips, paper circles or squares, in order to make up arrays. Given various numbers of chips, students should create all possible rectangles. For example, 12 chips yield 3 x 4, 2 x 6, and 1 x 12 rectangles, and the numbers across the top and down the side are labeled as factors of the whole. Students can compile lists of factors of numbers using this method.

2. **Picture Factors:** Have graph paper and scissors available. Let students pick a number from a bag and cut out the graph paper rectangles that show the factors of the number. Students can create a factor/multiple bulletin board by designing a "glittery" number and then gluing beneath it the labeled graph paper rectangles which describe its factors. Your room can become a large storehouse of multiples of factors for numbers 1 to 100.

3. Divisibility Rules: Give students the following divisibility rules and let them classify various numbers according to their factors.

a. A number is divisible by 3 if the sum of its digits is divisible by 3.
b. A number is divisible by 4 if it is last two digits are divisible by 4.
c. A number is divisible by 5 if it is last digit is 5 or 0.
d. A number is divisible by 6 if it is divisible by both 2 and 3.
e. A number is divisible by 8 if the last three digits are divisible by 8.
f. A number is divisible by 9 if the sum of its digits is divisible by 9.
g. A number is divisible by 10 if its last digit is 0.

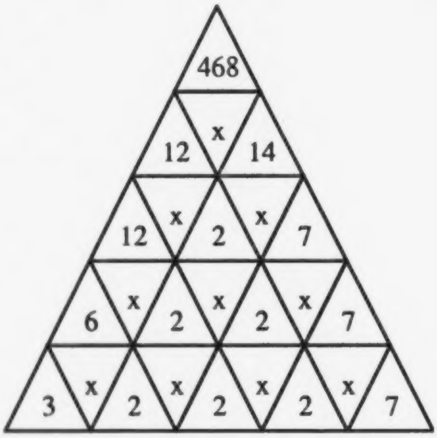
PRIMES AND COMPOSITES

1. Prime Arrays: See "Arrays" under Multiples and Factors, only this time let students discover numbers which have only one possible rectangle, 1 x the number itself. Students should create arrays for a chart of the prime numbers to 100.

2. Goldbach's Conjecture: Goldbach's Conjecture states that every even number greater than four can be expressed as the sum of two primes. There is no mathematical proof of this statement, therefore it is fun to have students test the possibilities. Let students find prime sums for all the even 2-digit numbers. Can they find more than one solution for these numbers? For example: 68 = 61 + 7 or 17 + 51 or 37 + 31. A chart of all the primes under 100 would be helpful in this exercise. Give student sets of 5 consecutive even 3-digit numbers for which to find pairs of prime addends.

3. Primeval Forest: Create triangular templates (see examples) for students to use in factoring various numbers into their primes. Create a "primeval forest" of these trees. Play with larger numbers as students learn more about tests of divisibility as an aid to factoring. Remember in testing a number, students need to divide only by primes that are less than the square root of the number.

Example: 468 = 3 x 2 x 2 x 2 x 7



SQUARES AND SQUARE ROOTS

1. Let's Make a Square: Cut out 100 1" paper squares and number them 1 - 100. Create a ditto of the following chart extending the numbers to 100 and leaving the columns "Square" and "Side Length" blank. Checking the numbers in order, students try to create squares and fill in the chart.

The number 1 stands alone and is a square. It is impossible to combine either the number 2 or number 3 squares with the number 1 square to create a larger square. Combining the number 4 square, students can create a larger square.

Why is the prime number two never used to create the sums?

An even number plus an odd number is always odd.

#	Square	Side Length
1	yes	1
2	no	
3	no	
4	yes	2
5	no	
6	no	
7	no	
8	no	
9	yes	3

2. Growing Squares: Cut one inch squares from several colors of construction paper. Let students create the smallest square possible. Then the next larger square, the next, the next, etc. Use different colors of construction paper for each subsequent larger square. This graphically demonstrates the number of square units added each time. The students should count and keep a record of the number of square units added. They should find the pattern 1 + 3 + 5 + 7 + 9 etc. This best works with student pairs so that one can build squares and the other can keep records.

3. Finding Squares: Let students find, measure, label, and find the area of squares throughout the school. Let them label posters of square figures and objects. Find a picture that has many "hidden" squares and let the students count them.

CUBES AND CUBE ROOTS

1. Let's Make a Cube: Follow the procedure for "Let's Make a Square" above, using small numbered cubes and the following chart.

# of cubes	base	height	width

2. Cube Check: Bring all sorts of boxes and blocks into the center for students to measure to find out which are cubes. Then let them multiply to find the volume of the cubes.

3. Cubic Confusion: If you have a cube made of 9 smaller cubes, stacked up 3 x 3 x 3 and you paint it on all sides and then take it apart, how many small cubes will have one side painted? 2 sides painted? 3 sides painted? No sides painted? Students may prove their hypotheses by putting together, painting or marking, and then taking apart a 3 x 3 x 3 cube. How about 4?

4. *Flatland*: This book, a classic science fiction tale by Edward A. Abbott, introduces the concepts of dimensions beautifully. It is appropriate for older students. An excellent film has been made based on the book.

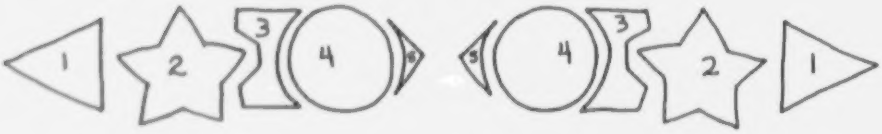
THE SYMMETRY OF PALINDROMES

1. The Geometry of Symmetry: Have available a wide variety of paper shapes. A student picks a shape and folds it in half to discover if the two halves are equal in size and shape. Students should make several folds -- horizontally, vertically, diagonally -- to find as many lines of symmetry as possible. Students should trace each symmetrical shape and draw in its lines of symmetry.

2. Picture Symmetry: Have students fold a sheet of plain white paper in half then place within it a piece of carbon paper, folded so that whatever is drawn will copy onto both halves of the inside of the paper. On the outside of the white paper, students should draw only one half of what they wish to depict and the entire object will appear inside the white paper. Vases, people, butterflies, designs or houses make excellent "picture symmetry."

3. Kaleidoscopes: Let students have fun with a kaleidoscope. Build in the vocabulary of color, movement, direction, shape, etc.

4. Pretty Palindromes: Cut paper into 5 distinct shapes, making many copies of each. Assign a different number to each shape. Write the corresponding number on instances of each shape and have students create symmetrical designs using the shapes. Once they have made their designs, from end to end in any given line, the numbers of the shapes will "read" the same backwards and forwards. These designs are palindromes. Students should design pretty palindromes of different lengths, shapes and numbers.



5. Wordy Palindromes: Words can also be palindromes. Let students discover some in English or in their (another) language. Here are a few English ones to get you started: **mom, dad, peep, radar, gag, bib, noon, civic, sees, ewe, deed, pop, Madam I'm Adam, Able was I ere I saw Elba.**

6. Mysterious Palindromes: Numbers may be turned into palindromes by reversing and adding. If you take 123 and add 321 to it, you will get 444, a palindrome. If you take 86 and reverse it and add 68, your sum is 154. Reverse that and add 451 to get 605. Add 605 and 506, you get 1111 -- a palindrome in three steps. Let students puzzle out palindromes from different numbers. How many steps does each take? Does this procedure always work? Perhaps, if you're patient. A computer program can be created to work these problems. Confer with your resident computer expert.

PERFORMING CALCULATIONS

Have a variety of manipulatives available at the center, such as pebbles and cuisenaire rods. Include reference sources such as tables found in dictionaries or encyclopedias, and calculators, so that your students can perform the many calculations necessary for filling in your data base. A computer spreadsheet, if it is available, is a great way to calculate the needed information.

Appendix B

GLOSSARY OF MATHEMATICAL TERMS

Attribute - A defining quality or characteristic. Example: An attribute of a car would be its color.

Composite - A number that has more than two factors; not prime. Example: 15 is a composite number, since its factors are 1, 3, 5, and 15.

Counting Number - The infinite sequence of numbers beginning with 1; all whole numbers except 0.

Cube (cubed) - 1. The resulting product when one number is used as a factor three times. 2. The process of multiplication through which one number is used as a factor three times. Examples: 27 is a cube (9 x 9 x 9), 8 is a cube (2 x 2 x 2)

Cube Root - For any number A, the number that when multiplied by itself twice equals A. Example: The cube root of 8 is 2, since 2 x 2 x 2 = 8.

Denominator - The expression below the line in a fraction. Example: 2 is the denominator in the fraction 1/2.

Difference - The result of subtracting a smaller value from a larger value. Example: 3 is the difference between 5 and 2.

Difference of digits - The result of subtracting the value of a smaller digit from that of a larger digit. Example: The difference of the digits in both the numbers 83 and 38 is 5.

Digits - The symbols of numerical value that compose a number system: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. There are only ten digits and they may occupy any place value. Example: The number 56 has two digits - a 5 and a 6.

Even - Any whole number evenly divisible by 2. Example: 2, 4, 6, 8 and 10 are the first five even numbers.

Factor (of a number) - A number that divides a given number, producing a whole number quotient. Example: Factors of 12 are 1, 2, 3, 4, 6 and 12.

Factors (proper) - All factors of a number, excluding 1 and the number itself. Example: The proper factors of 12 are 2, 3, 4 and 6.

Fraction (improper) - A fraction in which the numerator is greater than the denominator. Example: 4/3, 12/2, 9/5 are improper fractions.

Fraction (proper) - A fraction in which the numerator is less than the denominator. Example: 1/2, 5/9, 13/18 are proper fractions.

Fraction (unit) - A fraction in which the numerator is 1. Example: 1/2, 1/8, 1/10 are unit fractions.

Hundreds' digit - In decimal notation, the digit in the third place from the right. Example: 5 is the hundreds' digit in all four of these numbers: 1543, 11542, 532, 3582.

Mixed number - A numeral composed of a whole number and a fraction. Example: 3 1/3 is a mixed number.

Multiple (of a number) - The result of multiplying a given number by another number. Example: 15 is a multiple of 5, since 5 x 3 = 15.

Numerator - The expression above the line in a fraction. Example: 1 is the numerator in the fraction 1/2.

Odd - Any whole number not divisible by 2. Example: 1, 3, 5, 7 and 9 are the first five odd numbers.

Palindrome (palindromic) - A number whose value is the same when read left to right as it is when read right to left. Example: 12321 is a palindrome; 333 is also palindromic.

Prime - A number that has only two factors - 1 and the number itself. (1 is not a prime.) Example: 2, 3, 5, 7, 11 are the first five primes.

Prime factors (of a number) - Of any number A, the prime numbers that will divide A. Example: The prime factors of 30 are 2, 3, and 5.

Appendix B

Primes (twin) - Two prime numbers that differ by 2. Example: 17 and 19 are twin primes; 41 and 43 are twin primes.

Product - The result in a multiplication problem. Example: 14 is the product of 2 x 7.

Product of digits - The result of multiplying all the digits in a given number. Example: 24 is the product of the digits in the number 46; 30 is the product of the digits in the number 253.

Quotient - The result in a division problem. Example: 3 is the quotient of 18 divided by 6.

Quotient of digits - The result of dividing the value of a larger digit by that of a smaller digit. Example: The quotient of the digits in the number 93 is 3.

Set - Collection of items related by a common attribute. Example: All children born in the month of May are a set defined by the attribute of birth month.

Simplest (lowest) terms - The expression of a fraction in which all factors common to the numerator and the denominator have been divided out. Example: 6/8 = 2 x 3/2 x 2 x 2 = 3/4; 3/4 is expressed in simplest terms.

Square (squared) - 1. The resulting product when one number is used twice as a factor. 2. The process of multiplying a number by itself. Example: 4 is a square, since 2 x 2 = 4.

Square root - For any number A, the number that when multiplied by itself equals A. Example: The square root of 9 is 3, since 3 x 3 = 9.

Sum - The result of addition. Example: 8 is the sum of 5 + 3.

Sum of digits - The result of adding all the digits in a given number. Example: 8 is the sum of the digits in the number 134; 6 is the sum of the digits in the fraction 11/13.

Symmetry - Equal correspondence of opposite sides, divided by a central line.

Tens' digit - In decimal notation, the digit in the second place from the right. Example: 1 is the tens' digit in all three of these numbers: 12, 517, 18, 319.

Thousands' digit - In decimal notation, the digit in the fourth place from the right. Example: 3 is the thousands' digit in all four of these numbers: 13,442; 3,567; 33,532; 2,343,782.

Unique - Different from all other; consisting of one.

Units' digit - In decimal notation, the digit in the first place from the right. Example: 2 is the units' digit in all four of these numbers: 2, 42, 432, 3782.

Whole numbers - The set of Counting numbers and 0.

Adapted from:

Gregory, John and Seymour, Dale. (1978). ***I'm A Number Game****. Creative Publications: Palo Alto, Ca.*

Appendix C

GLOSSARY OF DATA BASE TERMS

Comparison Information: Data used to discover relationships for record selection.

Data: Information organized for analysis or used as the basis for a decision.

Data Base: A computer program or table which organizes, stores, retrieves, modifies, and reports data.

Entry: Each item of data entered into the data base; a record contains an entry for each field of the data base.

Field: Category by which data is organized; the columns of a data base.

File: A collection of information stored as a named unit on a disk.

Record: All the data about one item stored in a data base file; the rows of a data base.

Record Search: Selecting only certain records from particular fields; choosing records which satisfy a sets of attributes.

Relationship: Condition on which to base record selection, such as "equal to," "greater / less than," "begins with," "contains."

TANGLED PROBLEMS

These problems can be used as they are and can become formats for problems you create yourself. They cover a wide range of numbers as well as various whole number subsets. Problems marked with "*" can be solved with numerals from 0 - 25. Problems marked with "**" can be solved with numbers from 0 - 100.

I. DISGUISED DIGITS

These problems all expect the thinker to understand that each individual letter represents a single digit. These problems can also be created with the stipulation that they are double or triple digit numbers of a finite set of twenty-six elements.

* 1. A,B,C are all divisible by 3; A + A + A + A = BC; B x C= divisible by A; B + C = A
Solution: A = 9, B = 3, C = 6

* 2. A + BA + A + CA = 100; A, B, and C are all odd primes; C < B
Solution: A = 5, B = 7, C = 1

* 3. A + B + C + D = BE; A, B, C, D, E are all even; C > A > D > B
Solution: A = 6, B = 2, C = 8, D = 4, E = 0

* 4. ABC + DBE = 812; A, B, C, D, E are all even, A + D = C; A < D
Solution: A = 2, B = 0, C = 8, D = 6, E = 4

* 5. AB + CB = 134; A, B, C are all odd; A and C are divisible by 3; C > A
Solution: A = 3, B = 7, C = 9

* 6. AB + CB + DEB = AFB; A, B, C, D, E are all odd; F is not a counting number; C > E > A
Solution: A = 3, B = 5, C = 9, D = 1, E = 7

* 7. A + B + C = 21; A, B, and C are all odd; A > B > C
Solution: A = 9, B = 7, C = 5

* 8. A x B + A + B = C; A, B, and C are all squares; 2B + C = A
Solution: A = 9, B = 4, C = 1

* 9. AB + AB + B = CD; A, B, C, D are all counting numbers that are composite; A and C are square; (C/3) x 2 = B
Solution: A = 4, B = 6, C = 9, D = 8

*10. A x A x A = A + A + A + A; A is the only even prime.
Solution: A = 2

II. UNEARTHING THE UNUSUAL

"Unearthing the Unusual" can be done with sets named by more than one attribute, such as "all even primes,"or "odd multiples of 3 > 100 and < 200, etc.

1. Find the number that does not belong; 66, 333, 99, 111, 100, 88
Solution: 100. The other numbers are palindromes composed of repeated digits.

**2. Find the number that does not belong: 6, 12, 18, 30, 28, 9
Solution: 28. The other numbers are divisible by 3.

**3. Find the number that does not belong: 12, 20, 24, 16, 22, 28
Solution: 22. The other numbers are divisible by 4.
Alternate solution: 16. The other numbers contain a 2.

4. Find the one that does not belong: 66, 121, 707, 99, 101, 86
Solution: 86. The other numbers are palindromes.

*5. Find the one that does not belong: 21, 5, 9, 13, 14, 17
Solution: 14. The other numbers are odd.

6. Find the one that does not belong: 100, 98, 49, 604, 32, 998
Solution: 49. The other numbers are even.

**7. Find the one that does not belong: 10, 40, 60, 56, 80, 20
Solution: 56. The others are all divisible by 5.

8. Find the one that does not belong: 9, 169, 65, 81, 49, 121
Solution: 65. The other numbers are odd squares.

9. Find the one that does not belong: 193, 191, 337, 467, 281, 499
Solution: 193. The other numbers are three digit primes.

10. Find the one that does not belong: 4096, 64, 729, 1, 625, 15625
Solution: 625. The other numbers are both squares and cubes.

III. MAGICAL MYSTERY NUMBER

These problems are an especially good introduction to the use of Algebra as a deliberate, problem solving strategy. They place emphasis on using the language of mathematics.

** 1. Name the 8 sets of twin primes (primes that differ by two) less than 100.
Solution: 3-5, 5-7, 11-13, 17-19, 29-31, 41-43, 59-61, 71-73

** A. We are twin primes. Our sum is a two-digit number whose ten's digit is twice its unit's digit. What are our names?
Solution: 41, 43

** B. I am a prime, and I have a twin. The product of my twin's two digits is 8 more than the product of my two digits. Who am I?
Solution: 41

2. There are only 16 prime palindromic numbers less than 1000. What are they?
Solution: 11, 101, 131, 151, 181, 191, 213, 353, 727, 757, 787, 797, 919. 929

* A. I am the only 2 digit palindromic prime.
Solution: 11

B. I am a three-digit palindromic prime. My digits could be written as the variables A B A. I have a partner who is also a three-digit palindromic prime. His digits could be expressed as B A B. The sum of my digits is the first member of a set of single digit, twin primes; the second member of which is the sum of the digits of my partner.
Solution: 131

3. I am the only three-digit, prime counting number

A. Whose digits are all different and odd
B. Whose digit sum is 13
C. Whose digit product is greater than 30
D. The sum of whose tens and hundreds digit is less than my units digit.

Who am I?
Solution: 157

4. I am the smallest three-digit square number whose digit sum totals a number that is not a square. Who am I?
Solution: 256

** 5. I am the smallest number other than 1 that is both a square and a cube. Who am I?
Solution: 64

6. I am the only palindromic, three-digit cube. Who am I?
Solution: 343

* 7. I am a factor of 50 and an even multiple of 5. I am one more than a square and two more than a cube. Who am I?
Solution: 10

8. I am an odd three-digit number. I am the sum of 3 different odd cubes. My units and tens digits are alike. Who am I?
Solution: 855

9. I am the only number who, when added separately to 100 and 164, will make them both perfect square numbers. Who am I?
Solution: 125

*10. I am the smallest one-digit odd prime number. Who am I?
Solution: 3

*11. I am a square number and both my digits are square numbers. Who am I?
Solution: 49

*12. I am the only two-digit odd, composite number less than 20. Who am I?
Solution: 15

*13. I am a prime number and a factor of 105, 20 and 30. Who am I?
Solution: 5

14. I am the only three-digit square other than 400 containing all even digits. I am a palindrome. Who am I?
Solution: 484

**15. I am a square. The sum of my two digits is my square root. Who am I?
Solution: 81

16. I am larger than 15^2 and less than 16^2. I'm odd and divisible by 3. The product of my digits is 24. Who am I?
Solution: 243

**17. I am a multiple of 7. I'm a factor of 210. The product of my two digits is odd. Who am I?
Solution: 35

**18. I am an even multiple of 3. I'm greater than 5^2 and less than 7^2. The product of my two digits is a cube. Who am I?
Solution: 42

**19. We are two-digit primes. If our digits are reversed, we become different primes. The products of our digits are also prime. We are four numbers. Who are we?
Solution: 13, 17, 31, 71

20. I have 3 digits. One of my digits is a square and two are cubes. All three digits are different. My digits are ordered smallest to largest, left to right. The product of my digits is greater than 10. Their sum is less than 15. Who am I?
Solution: 148

*21. I am divisible by only one prime number. The sum of my digits is a prime, and the difference between my digits is another prime. I am less than 40. Who am I?
Solution: 16

22. I am a three-digit palindromic number. The sum of my digits is a prime, and the difference between my digits is another prime. I am less than 40. Who am I?
Solution: 333

23. I am a three-digit palindrome. The sum of my digits is even. I am the difference between a palindromic cube and a palindromic square. Who am I?
Solution: 222

*24. We are 6 consecutive multiples of 5 which, when added together, make a sum between 340 and 350. Who are we?
Solution: 50, 55, 60, 65, 70, 75

**25. We are 2 consecutive prime numbers whose product is 899. Who are we?
Solution: 29, 31

**26. I am the decade between 50 and 150 in which there are four prime numbers. Who am I?
Solution: 51 to 61

**27. I am an odd two-digit prime number whose digit sum is 11. My tens digit is greater than my one's digit. Who am I?
Solution: 83

All whole number problems can be reworked to become fraction problems as are the three below:

*28. I am a proper fraction. The sum of my numerator and denominator is a one-digit square. Their product is a cube. Who am I?
Solution: 1/8

*29. I am the proper fraction whose denominator and numerator when multiplied is a multiple of 7 and when added is a perfect square. Who am I?
Solution: 2/7

*30. We are three fractions each of whom has a value less than one-half. Both our numerators and denominators are one-digit primes. Who are we?
Solution: 2/5, 2/7, 3/7

IV. STIMULATING SIMULATIONS

*1. Sara took her younger brothers and sisters to the park. She and her siblings are all two years apart. All the children are less than twelve years old, and all their ages are even numbers. There are three possible ages they could be. What are they, and which one is likely to be true for this family?
Solution: 2, 4, and 6; or 4, 6, and 8; or 6, 8, and 10. The children are likely to be 6, 8, and 10 because most mothers would not entrust anyone younger to escort siblings to a park.

2. Scenario: Worker must sort boxes and number sets. (See "The Box Problem.")

A. Boxes labeled:
   1. multiples of 8
   2. square numbers > 10
   3. even multiples of 5
   4. odd prime numbers
   5. cubes less than 250
   6. squares whose roots are less than 10
   7. etc.

B. Sets of numbers to put in boxes:
   1. 8, 16, 24, 32, 48, etc.
   2. 16, 25, 36, 49, 64, etc.
   3. 10, 20, 30, 40, 50, etc.
   4. 3, 5, 7, 9, 11, 13, etc.
   5. 1, 8, 27, 64, 125, 216
   6. 1, 4, 9, 16, 25, 36, 49, 64, 81

*3. There are five numbers in the boxes below. Each number is associated with the prize listed below. Using the following clues, determine the prizes that go with the boxes by deducing which numbers are in the boxes. Which prizes cannot be won?

present
present present present
present

1. There are no primes in the horizontal row of three boxes. The sum of the numbers in the horizontal row is not prime.

2. There are no composites in the vertical column of three boxes. The sum of the numbers in the vertical column is not composite.

Prizes:

1. apple
2. dress
3. watch
4. car
5. package of stickers
6. soccer ball
7. two weeks paid tuition to camp
8. Apple //e computer
9. book

Solution: the dress, stickers, ball and computer cannot be won.

7-tuition
4-car 1-apple 9-book
3-watch

*3. This is the same type of problem as #44. There is a pattern of boxes in which there are numbers. The problem is to deduce which numbers go in which boxes. Attributes of the numbers are given to direct the problem solver. Three different versions of this problem are given below.

1. Pattern to follow:

RULES #1

1. Use all digits from 1 to 9.
2. The numbers in the four corner boxes are all odd.
3. Row one has three consecutive odd numbers.
4. One of the diagonals contains prime factors of 84.
5. Row one's numbers are factors of 30.
6. The numbers in column 1 are factors of 72.
7. Column 3's sum is twice column 1's sum.
8. Column 1's sum is equal to row 3's sum.

Solution:

3	1	5
8	2	6
9	4	7

RULES #2

1. Use all the digits from 0 - 8.
2. No number is used twice.
3. The sum of row 2 is 13.
4. Row 3 has even, consecutive numbers.
5. The sum of the four corners is equal to the sum of the first row.
6. The numbers in columns 2 and 3 and row 3 are counting numbers.
7. All the numbers in row 2 are odd.
8. The sum of column 1 is less than 8.
9. There are no composites in Row 2.
10. There are no primes in Column 2.

Solution:

0	8	3
5	1	7
2	4	6

RULES #3

1. Three is the only digit not used.
2. No digit is used twice.
3. The digits in the third row are all odd.
4. The digits in the second row are all even.
5. Seven is not in the same row as five.
6. Six and eight are in the same row but different columns.
7. Two and eight are in the same column but in different rows.
8. The sums of row 1 and column 1 are 13.
9. The sums of row 2 and column 2 are 14.
10. The sums of row 3 and column 3 are 15.

Solution:

4	7	2
0	6	8
9	1	5

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CULTIVATING PLANT CONCEPTS AND COMMUNICATION

by
Cynthia Ashurst First

Unit 3 / Grades K - 2

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CULTIVATING PLANT CONCEPTS AND COMMUNICATION

Is there a drought in your classroom? Has the supply of motivation and excitement for learning dried up? Here'a a remedy: the rain of ideas and activities to get you blooming again!

This unit integrates science, math, and language, and is designed for English as a second language students and native English speakers in kindergarten through second grade. A field trip activity, a nature walk around the schoolgrounds, introduces the unit. The information and materials gathered on the walk are used for various activities and learning centers in the classroom. Learning centers provide the primary learning structure for the unit. After a careful introduction to centers by the teacher, students participate individually or in small groups in activities at the centers independently or with teacher support.

The lessons, nature experiences, learning centers, games and hands-on experiences used in this unit encourage and provide many opportunities for listening, observing, talking, creating, comparing, collecting, sorting, classifying, counting, measuring, weighing, graphing and thinking.

Water this unit with your enthusiasm and ideas and turn your classroom into a learning garden where all your students bloom!

CULTIVATING PLANT CONCEPTS AND COMMUNICATION
OBJECTIVES

Activities **Objectives** **Unit 3 / Grades K-2**

1	2	3	4	5	6	7	8	9	C*	MATHEMATICS
		●	●	●					●	Organizes elements of sets according to characteristics (GBC K,1,2).**
									●	Recognizes sets that are equivalent (GBC 1,2).
									●	Identifies standard geometric shapes and relations (GBC K,1,2).
	●								●	Measures length using nonstandard and standard (customary and metric) units (GBC K,1,2).
									●	Determines amounts of money - a collection of up to $1.00 and change less than $.50 (GBC K,1,2).
	●			●					●	Interprets data on simple graphs (GBC 1,2).
			●						●	Uses the operation of addition in context of academic material and everyday acts (GBC 1,2).

1	2	3	4	5	6	7	8	9	C	SCIENCE
●	●								●	Differentiates between living and nonliving material (GBC K,1,2).
	●					●	●	●	●	Observes changes in living things: growth cycles (GBC K,1,2).
	●					●	●	●	●	Recognizes certain needs of living things: water, foods, temperature (GBC 1,2).
			●	●					●	Identifies and compares objects by characteristics such as textures, lighter, heavier, and larger, smaller (GBC K,1,2).
●	●	●	●	●	●		●		●	Identifies the parts of a plant: roots, stem, leaves, flowers, fruit, seeds.
●	●						●		●	Recognizes that plants get food from the soil through roots.
		●		●	●	●		●	●	Identifies parts of plants that are eaten.
					●					Recognizes that paint or dyes can be made from certain plants.

CULTIVATING PLANT CONCEPTS AND COMMUNICATION
OBJECTIVES

Activities **Objectives** **Unit 3 / Grades K-2**

1	2	3	4	5	6	7	8	9	C*	**LANGUAGE ARTS**
●	●		●	●	●	●	●		●	Uses elaborated language to describe and interpret experiences, objects, pictures, and feelings (GBC K,1,2).
●	●	●	●	●	●	●	●		●	Uses conventional language patterns (GBC K,1,2).
●	●	●	●		●	●	●	●	●	Interprets oral and/or written instructions (GBC K,1,2).
●	●					●			●	Retells information presented orally (GBC 1,2).
	●				●	●			●	Makes predictions (GBC 1,2).
						●	●	●	●	Makes judgements (GBC K).
●	●			●					●	Describes experiences (GBC K).
●	●				●	●	●		●	Tells a story or happening in sequence (GBC K).
●	●					●		●	●	Recognizes explicitly stated main ideas, details, sequence of events and cause-effect relationships (GBC 1,2).
						●		●	●	Identifies main character (GBC K,1,2).
	●								●	Matches beginning sounds, ending sounds, letters and rhyming words (GBC K,1,2).
●	●						●		●	Writes creatively (GBC 1,2).
●	●				●	●	●		●	Dictates meaningful information to adult for experience story (GBC K).
									●	Copies simple shapes, designs, numbers and letters (GBC K).
●	●								●	Understands left to right pattern of writing (GBC K).
●	●			●	●		●		●	Observes for a purpose and uses language to describe observations.
●	●	●	●	●	●	●	●	●	●	Associates the real object with the spoken word, written word, and picture of the object.
●	●	●	●	●	●	●	●		●	Uses question and answer form.
●	●	●	●	●	●	●	●		●	Uses language in full group, small group, and peer situations for specific sociolinguistic purposes such as planning, decision making and sharing tasks and materials.

CULTIVATING PLANT CONCEPTS AND COMMUNICATION

OBJECTIVES

Activities **Objectives** Unit 3 / Grades K-2

1	2	3	4	5	6	7	8	9	C*	**ART**
						●			●	Pastes, draws, weaves, models and cuts with art tools and materials (GBC K).
					●	●			●	Repeats a design (line,shape, color) to form a pattern (GBC 1,2).
	●				●	●			●	Creates original art work expressing ideas and feelings (GBC K,1,2).

1	2	3	4	5	6	7	8	9	C	**PHYSICAL EDUCATION**
●									●	Develops gross motor skills (GBC K,1,2).
●	●								●	Creates, performs, and participates in simple games (GBC K,1,2).
●	●								●	Works with other students in a team situation.

* Centers

** Georgia Basic Curriculum objective for listed grade level(s).

1. A NATURE WALK

Introduce this unit about plants by taking a walk outside and enjoying and appreciating the wonders of nature. Students will collect many nature materials which will be used in the centers. This trip, as every field trip should be, is like a sandwich. The meat, the trip itself, is secured between two slices of bread which make it easy to hold and add to its flavor. The "bread slices" are the activities of preparing students for the trip before the experience, and of following-up on trip experiences afterwards.

Procedures:

Large group, teacher directed
Small groups, teacher available

Before the trip

1. Ask students to sit on the floor in a circle. Place the plant in the middle of the circle. Ask the students to tell you everything they know about plants.

2. As the students discuss the plant, write down what the students know about plants on the chart paper. Using the information students have provided and your goals for the lesson, write four questions about plants for the students to answer after their nature walk.

3. Discuss the nature walk procedures and safety rules. Advise students to take only fallen objects such as leaves and seeds and not growing things. Warn students away from dangerous plants: plants with thorns, poison ivy or poison oak.

4. Divide the class into four groups. Give each group a question to answer during the walk and a large bag in which to put leaves, roots, seeds, etc., that they collect on the walk.

During the trip

5. Organize students into their groups from the pre-field trip lesson. Encourage students to use all of their senses for observations. Refer to the five senses pictures as a help.

6. Elicit talk about what students are finding and experiencing. Listen to the students as they talk to each other. Help the students to find the answers to the questions they asked while preparing for the trip. Elaborate on the students' language.

7. Make sure there are at least ten or twelve of each found item (12 leaves, acorns, etc.) to be used later in the center activities.

After the trip

8. Have students sit in their groups on the floor. Read a question from the chart that you made before the trip. If students have trouble answering the questions, encourage them to ask for help from other class members. Write the answers to the questions on additional chart paper.

9. Give each student the opportunity to describe an item he/she found. Prepare the students to dictate an experience story by encouraging them to remember and recount the sequence of events of the trip. Write as students dictate. Ask more proficient students to write their own stories.

10. Have students read their stories to the class individually or have them read the class story in chorus.

11. Reproduce the class story so that each student has a copy to read and illustrate.

Materials: Chart paper.
Marker.
Potted plant.
Flower.
Leaf.
Seed.
Four shopping bags.
Pictures of the sense organs: mouth, nose, skin, eye, ear.

Evaluation:

1. Use pupil participation in the discussion on the trip and contributions to the experience story to determine what each student has mastered. Use this information to choose appropriate next lessons to meet the needs of your students.

2. Ask individual students to read the experience story and/or tell about the illustrations (depending on student proficiency).

Extensions:

1. For Homefun, ask students to take the experience story home and read it to friends and family.

2. Ask students to find some seeds of plants from around their houses to add to the class collection. Have students borrow plant identification books, and ask students to work with their parents to find the names of three different plants growing inside or outside of their homes.

2. GROWING A SOCK

This activity is especially appropriate for late summer or fall. Students walk in tall grass and weeds somewhere near the school. Seeds collect on their socks. They bring the seeds back to the classroom to water and watch.

Procedures:

Large group, teacher directed

1. Talk about seeds and how they travel. Ask students if seeds have ever stuck to them before. Tell students they will be collecting things on a walk, but that they will not use their hands to collect items as they did last time. Ask questions that will help the students think of ways to collect things without using their hands. Help them discover that this time they will collect seeds on their socks.

2. Have students put on their special socks, right over their shoes if the socks are big enough. Take the students for a walk through tall grass and weeds.

3. Ask students questions about what they feel, hear, see, and smell. On the walk back to the classroom, ask the students to look at their socks.

4. In the classroom, provide time for a discussion on how and why the seeds stuck to the socks. Discuss methods of seed dispersal.

5. Divide the class into pairs and give each pair of students one pan. Instruct the students to remove one sock carefully and place it in the pan. Have the students label their pans (name and date on tape). Ask each pair of students to prop their pan up on a block and fill the bottom of the pan with water. Have each pair of students place their pan in a warm place to sprout.

6. Check each sock for seeds. Help students sprinkle some grass or radish seeds on the socks to assure that something will grow. Ask students to predict what will happen. Instruct them on the needs of plants and necessary care for their seeds.

7. Prepare "sock journals" using blank sheets of paper and adding a cover. You may choose a plant or sock shape for the journal. Ask students to think of and write down or dictate titles for their journals. Encourage students to add illustrations.

8. Set aside a certain time each day for students to observe the socks, and to sketch and write in (or dictate for) the sock journal about what they have seen.

Materials: Old, mismatched, long, fuzzy socks (ask students to bring these from home).
Tall grass to walk in.
Large rectangular pans or trays.
Water.
Blocks to prop pans up on an angle.
Radish Seeds.
Grass Seeds.
Paper and writing and drawing materials for sock journals.

3. FARMER GREEN EATS VEGETABLES

This outdoor game is patterned after the familiar, "What time is it, Mr. Fox?" Games like this can be an enjoyable way to practice language patterns and reinforce science vocabulary and concepts.

Procedures:

Large group, independent

1. Pick one student to be the first "Farmer Green." Place the student about five yards away from the rest of the class. Divide the rest of the class into groups of four or five and ask each group to decide what vegetable it will represent (e.g., potatoes, carrots, broccoli).

2. The farmer starts the game by saying, "I'm very hungry today!" The class asks him, in chorus, "Farmer Green, what are you going to eat today?" The first few times the question is asked, the farmer gives an answer that is not a vegetable, e.g., chicken, pancake, cheerios, hot dogs.

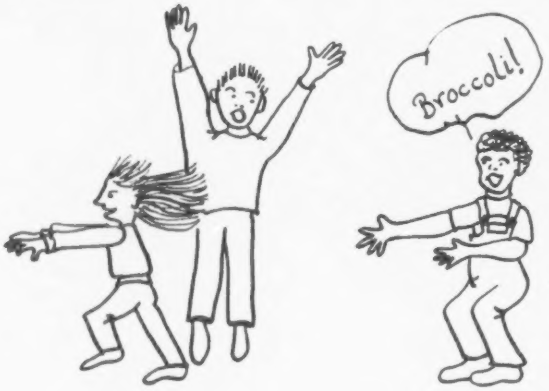
3. Each time they ask the question, the children in the class may creep closer to the farmer. When the farmer names a group's vegetable, however, they must run back to the starting line before the Farmer catches them. If a person is caught, he or she must exchange places with the Farmer. If the Farmer does not catch anyone he/she will be the Farmer again.

Evaluation:

Observe the students' use of the language patterns of the game, and their classification of vegetables.

Extensions:

1. The possible variations of this game are infinite. The game may be altered to practice many aspects of the unit. The categories could be plant/nonplant, fruits, or plants of which particular parts are eaten, such as seeds, stems, roots, or leaves.



Materials: None.

4. TEXTURE RELAY

This activity uses all the "junk" collected on the nature walk in still another way.

Procedures:

Large group

1. Review texture terms as you and the students study and discuss the contents of one of the bags.

2. Divide students into teams of about five children. Tell each team you will call out a texture such as "soft," and a member from each team must run to the bag and find the item that is soft. Then he/she must run back to the group. Each student on the team will be asked to find a different texture.

3. Assign points for being the first team to find the item with the correct texture. For example, each winner could get four points, second place three points, third place two points and fourth place one point. Explain that if a student has the wrong texture his/her team will not get a point for his/her turn.

4. Assign a student scorekeeper from each team to help tally the points, and explain to the students how to keep tally marks.

5. Encourage the students to practice command forms by cheering for their teammates, e.g., "Come on, Than, find rough!"

Evaluation:

Observe students' use of language forms, correct identification of textures, and scorekeeping. Ask individuals to count up points to check counting skills and knowledge of number terms.

Extensions:

The game can be adapted for many other classification categories related to this unit, including foods that are a particular part of plants, or objects that can be classified as animal, vegetable, or mineral, etc.

Materials: 4 bags of found materials, each containing items of various textures, such as:
burdock - prickly
rock - hard
acorn (bottom) - smooth
flower - soft
pine cone - rough
Blackboard and chalk, or paper and pencils for scorekeeping.

5. WHAT PARTS OF A PLANT DO WE EAT?

Snack time can be a learning time, too. As an ongoing activity during the unit, have a tasting time, during which your students can try and evaluate foods from all the parts of a plant.

Procedures:

Small group, teacher led

1. Discuss the various parts of a plant which can be eaten: leaf, root, stem, flower, seed, fruit. Put one plant part at the top of a column on the blackboard or chart paper, and ask students to name foods which belong in each column.

2. During the unit, name each day after a part of a plant, e.g., "leaf day," and have a snack each day which comes from that part of a plant. You may be able to get parents to volunteer to bring in the various foods.

3. As you eat the foods, discuss with the students what they are eating and what part of the plant the food is taken from. Encourage the students to think of other foods that fit into the category of the day. Ask students about the taste, smell, feel, color shape, size and sound (breaking and chewing) of each item they choose.

4. Have students record their preferences, and graph the information. Encourage students to interpret the graph and practice comparative language forms by asking questions such as:

What part of the plant do the most students like?
What food is the favorite in this class?
What food is liked least?
How many more people liked strawberries than okra?

Ask the students to think of more questions to ask one another about the graph.

Evaluation:

Select a sample of the questions about the graph, and ask students to answer them independently. Use taped questions with a picture answer sheet for students not yet comfortable with reading English.

Extension:

Have a big tasting event on one day, rather than tasting one plant part each day. Ask each student to bring in one edible plant cooked, or, if raw, cut in small parts to share with the class. Have the students categorize all the foods that they have to sample. Encourage students from other countries to bring favorites from their native cultures to share with the class.

Materials: Blackboard and chalk or chart paper and markers.
Knife.
Hammer (for the coconut).
Napkins.
Leaf Day - lettuce, spinach, cabbage.
Root Day - sweet potato, beet, carrot, potato.
Stem Day - broccoli, asparagus, celery.
Flower Day - cauliflower, broccoli.
Seed Day - sunflower, peanut, coconut.
Fruit Day - tomato, kiwi, apple.

6. TIE AND DYE WITH PLANTS

Plants not only provide good eating, they also serve as great material for art projects! In this activity, students will make plant dyes and then use them to create tie-dyed masterpieces.

Procedures:

Small group, teacher directed

1. Work with one third of the class at a time to make each dye, and prepare fabric for dyeing (the others can be working at centers). Ask students to name the fruit or vegetable to be used to make dyes. Ask the students to tell you what part of the plant you will use. Lead a discussion on how each food smells, tastes and looks.

2. Ask the students to tell you what color the water will be when each fruit or vegetable is cooked. Explain that plants can be used to make paint or dye.

3. Cut up the items and boil them for 20 minutes. Add salt to the boiling item to preserve the color (dyes will still tend to wash out).

4. While the items boil, ask each student to bring his/her shirt or material to the group. Show the students how to tie off parts of the material or shirt with rubber bands, see examples on page 3-14.

5. Once the item is boiled, show the group the dye made in the process.

6. Cool the dyes completely. Have the children take the fabric and dyes outdoors for dyeing. Have the students dip different "banded" parts of the material into the different dyes.

7. Have the students choose and name the color or colors they wish to use. Talk about the plant and the part of the plant used to make each dye. Ask the students who are finished dipping to undo all the rubber bands. Admire the beautiful products, and have the students hang up their shirts or fabric to dry.

8. Ask the children to write, dictate or draw stories about the experience of making dyes and tie-dyeing. Have the whole class dictate a story for you to write. You might choose to fold the paper into fourths, and show the steps in the sequence of tie-dyeing.

Materials: Hot plate.
Three old pots for cooking dye.
5 lemons - yellow.
Bunch of spinach - green.
8 beets - red.
Salt.
Water.
Rubber bands.
Knife.
Old white T-shirts (brought from home) or old white sheet, cut into squares.

9. Ask the students to read the class story or their individual stories to the class. Have students wear their tie-dyed shirts to another class and ask your students to explain to the class how they made their designs.

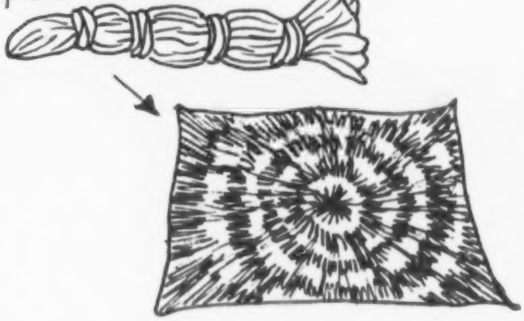
Evaluation:

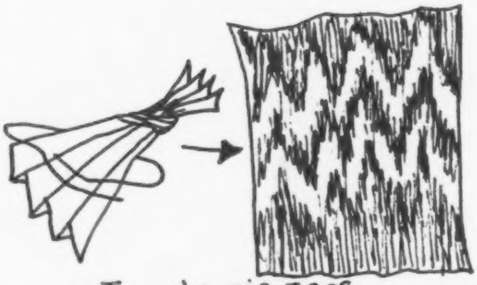
Listen carefully to childrens' responses in the small groups. Do they know the color terms? Can they tell which part of each plant was made into dye?

Extension:

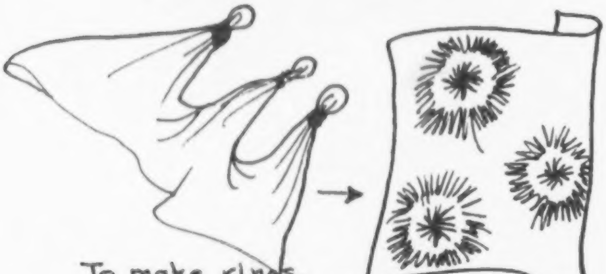
If you dyed fabric squares, you may choose to use them as flags or banners, to mat them and display them on the wall, or to glue them around cardboard rectangles to make very attractive covers for hand-bound books or plant journals.

To make target or spider web, pull whole garment to a point and band.

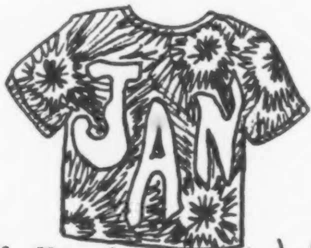




To make zig-zags, pleat and band at an angle.



To make rings, pull up small pieces and band or knot.



Fabric can also be painted with wax to resist dye.

7. THE LITTLE RED HEN

Children love to don costumes and act out stories! Such activities enhance language skills and help children learn story structure and sequencing.

Procedures:

Large group, teacher directed

1. Read or tell the story of *The Little Red Hen*. Encourage the students to join in as you tell the story, making predictions about what the animal will do, and joining in on repeated phrases.

2. Lead a discussion about the story that encourages the students to tell the sequence of events. Ask the students why they think the dog, cat, and rat did not get any bread.

3. Choose students to play the parts of the characters in story. Give them props and costumes to suggest the story action. See illustration below for costume suggestions. Encourage the non-actors to participate as a chorus by joining in on repeated phrases.

4. Repeat the play with different students playing the animal roles.

Materials:

The Little Red Hen, by P. Galdone (or another version).
Seeds.
Tall grass or real wheat stalks.
Sack of flour.
Bread pan.
Markers, chart paper, pencils, paper.
Simple paper costumes (optional) for dog, cat, chicken and rat.

Evaluation:

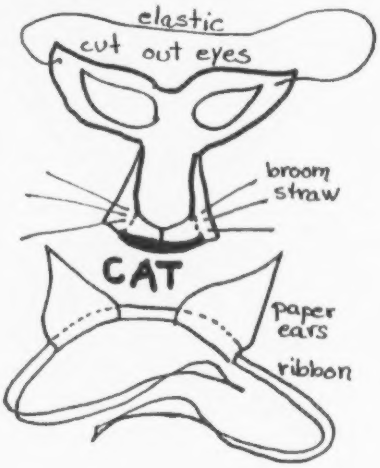
Ask individual students to tell you the story at lunch or playground time, and note the sophistication of their language and their memory of story structures and sequence.

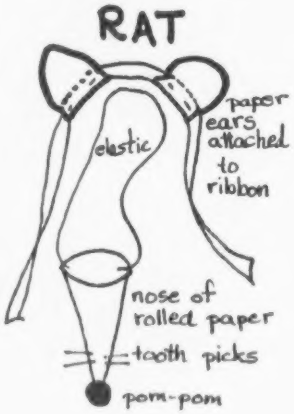
Extensions:

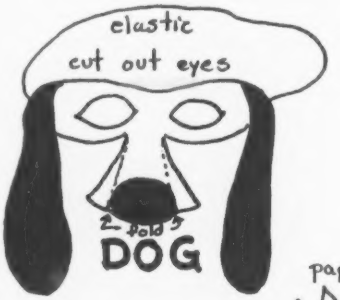
1. Provide felt board characters and felt board in the language arts learning center so that students can retell the story to one another.

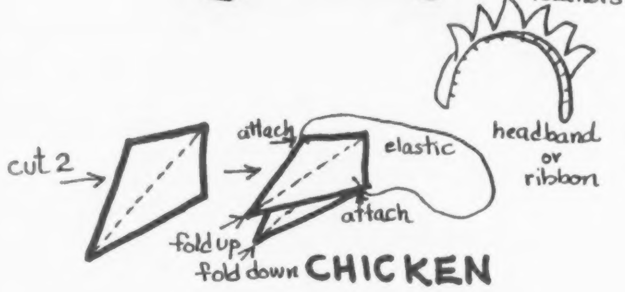
2. Write an original class story using the known story structure of *The Little Red Hen*.

3. Encourage students to write or dictate stories about a task they had to accomplish.


elastic
cut out eyes
broom straw
CAT
paper ears
ribbon


RAT
paper ears attached to ribbon
elastic
nose of rolled paper
tooth picks
pom-pom


elastic
cut out eyes
2 fold 3
DOG


paper feathers
headband or ribbon
cut 2
attach
elastic
attach
fold up
fold down
CHICKEN

8. HOW A PLANT GROWS: A MURAL

Let everyone in the school know how much you have learned by making a giant mural that shows how plants grow.

Procedures:

Small groups, teacher available

1. Divide the students into small groups of three or four.

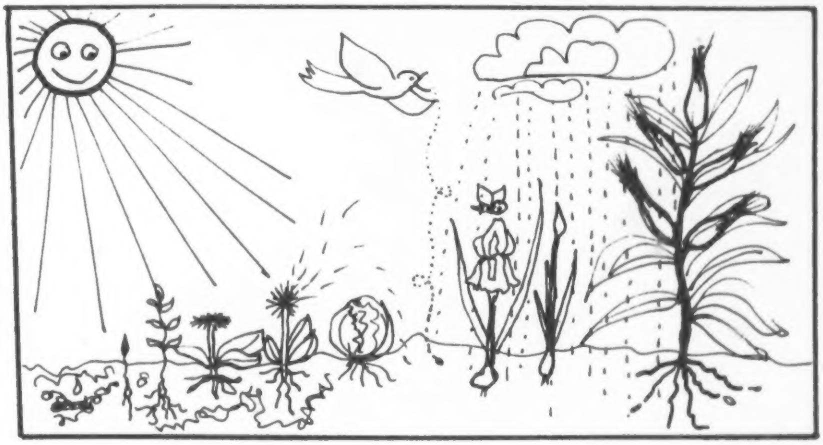
2. Discuss the growth of a plant with the class and have each group choose something that they have learned about plants to describe, e.g., the parts of a plant, plants we eat, how seeds travel, how plants grow from seeds, what plants members of this class like to eat, what plants need in order to grow. Encourage the students to apply what they have learned about plants in constructing the mural.

3. Encourage the students to choose which group will do what. Have each group work on its part and then paste the parts on the final mural. Provide help when needed in designing and labeling the mural.

4. Have each student write or dictate a description of a part of the mural. Mat descriptions and post them on or near the mural.

Evaluation:

Use this activity as an assessment of the students' knowledge of the plant concepts and vocabulary taught in the unit and their ability to apply the knowledge to the construction of the mural and the writing or dictating of the story about plants.



Materials:

Large butcher papers.
Paint.
Colored chalk.
Crayons.
Scissors.
Glue.
Tape.
Paper.
Pencils.
Different colors of construction paper.
Found materials (roots, stems, leaves, seeds, flowers).

9. UNIT EVALUATION: SOPHY'S GARDEN

In this final activity, students listen to a story about growing plants and then answer questions about what they have learned throughout the unit. Adjust the activity according to the levels of your students. The assessment may be administered individually, in small groups or with the full group. Students may read the story themselves, or it may be read to them.

Procedures:

Large group, small group
or individual

1. Read the story to the students (or place the tape at the listening center, or have students read it themselves, depending on your students' independence).

2. Ask the questions on the following page (or have students read them) and have the students bubble in the answers on the answer sheet.

Extensions:

1. Explore a mini-environment (such as organisms under a rock) and map the food chain.

2. Plant a class garden in pots or in a plot near the school. Keep journals and charts on plant growth, and celebrate your harvest with a salad feast.

Sophy's Garden

Sophy wanted some fresh carrots but she didn't want to get them from a store. She wanted to grow them herself. Sophy asked her mother if she would buy some carrot seeds. The next day when they went to the store her mom bought the carrot seeds. Sophy could not wait to get home and plant the seeds.

Sophy picked a special sunny place in the back yard for her garden. Her mom helped her dig up the dirt and mix it with special fertilizer which helps plants grow.

Sophy used the hose to wet the dirt and then she made little holes in the ground with her finger. She made two straight lines of holes. Then she dropped one seed in each hole, covered each one with dirt and watered it.

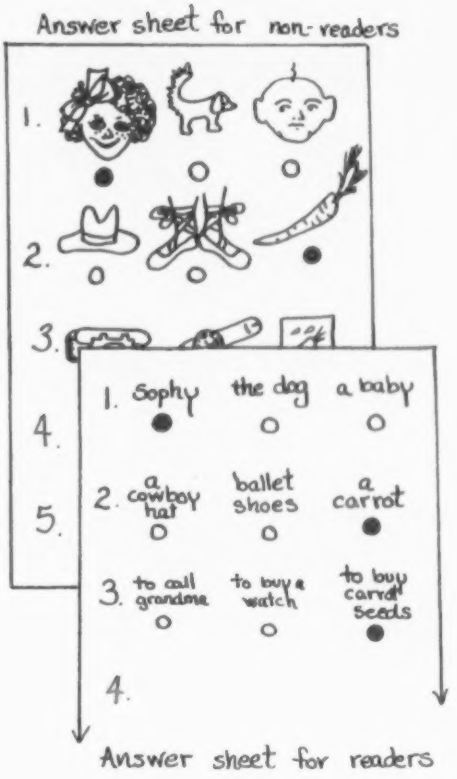
Sophy watered her garden every day and pulled up any weeds that started growing around her garden.

One day she saw tiny green leaves growing. They were in two straight lines. Finally the day came when her mother said, "Sophy, your carrots are ready to be picked." Sophy was so excited! She ran to her garden and carefully pulled up all her carrots. She had twenty-four carrots! Sophy could hardly carry all those carrots to the house. She washed all the carrots and then picked the prettiest one to eat. Crunch-crunch, it was the best carrot Sophy had ever eaten!

Materials: Sophy's Garden, the story above..
Picture or verbal answer sheet (see sample on page 3-18).

Questions:

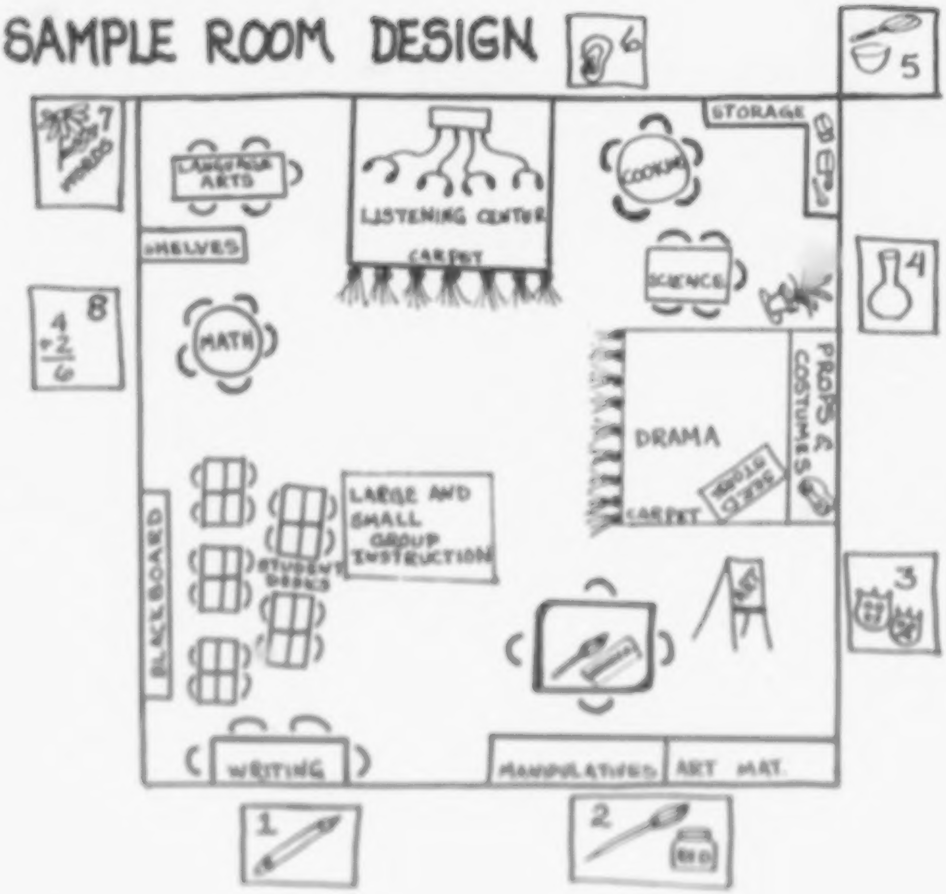
1. Who was the story about?
2. What did Sophy want?
3. What did Sophy ask her mother?
4. What did Sophy do first?
5. What did she do every day?
6. How did Sophy know the carrots were growing?
7. What made Sophy so excited?
8. How many carrots did Sophy grow?


Answer sheet for non-readers
1.
2.
3.
4.
5.
1. Sophy ● the dog ○ a baby ○
2. a cowboy hat ○ ballet shoes ○ a carrot ●
3. to call grandma ○ to buy a watch ○ to buy carrot seeds ●
4.
Answer sheet for readers

Cultivating Plant Concepts and Communication

Appendix

SAMPLE ROOM DESIGN


6
5
7
STORAGE
LANGUAGE ARTS
LISTENING CENTER
CARPET
COOKING
SHELVES
SCIENCE
4
8
4
+2
6
MATH
DRAMA
PROPS & COSTUMES
CARPET
LARGE AND SMALL GROUP INSTRUCTION
STUDENT DESKS
BLACKBOARD
3
WRITING
MANIPULATIVES
ART MAT.
1
2

LEARNING CENTERS

CREATING A LEARNING-CENTERED CLASSROOM

Learning centers are integral to this unit. In the centers, children discover and verify unit concepts while they practice unit language. Since some teachers are not familiar with managing a classroom with learning centers, this section includes suggestions for setting up the physical environment for learning centers, teaching children to use the centers, grouping children for centers, and scheduling center use.

Setting up the Physical Environment

Learning centers demand a versatile room design that allows for full group instruction, small group instruction, and independent activities of individuals, pairs, and small groups of children at centers. The sample room design, on page 3-20, shows such a versatile classroom. Because centers are to be used by students without direct teacher supervision, they should be designed to make their use and purposes clear to students. Label centers clearly with numbers or rebus symbols. Make the locations of materials within the centers clear by using picture labels, so students can easily find things and put them away.

Teaching Children to Use the Centers

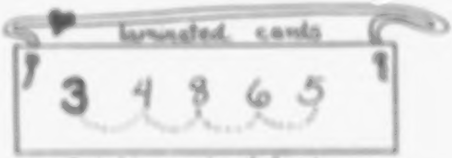
At the beginning of the unit, introduce the activities for each learning center to small groups of students. You may choose to divide the class into three groups. Two of the groups can work on independent teacher assigned activities while you are introducing the centers to the other group. The students can be rotated at short intervals until all groups have had the center explanations. Although a paraprofessional or parent volunteer would be very helpful in managing the centers with young children, careful design of activities, which children should be able to do independently, and careful introduction of these activities will permit you to manage this classroom alone. Thorough instruction in center procedures and several "dry runs" will help children become competent center users.

Grouping Children for Centers

To provide the best language learning opportunities in centers, group the students yourself. Pay special attention to separating nationalities as much as possible so that children will have to speak English to communicate. Place strong language models in each group if at all possible. For independent work at the centers, groups of about four work best.

Scheduling Center Use

A center Group Assignment Board (see example on page 3-22) enables the students to find their assigned groups for each day. Each shape represents a group assignment. Each group has its own rotation schedule. For example, the "Hearts" will go to centers 3, 4, 8, 6, 5 on the day shown in the example. Students are assigned to a different shape each day so that they will have a chance to use all the centers. Students' names are moved to the next pocket at the end of each day. If necessary, students can take their rotation schedules with them to the centers in the form of tags to be worn around their necks (see example below).

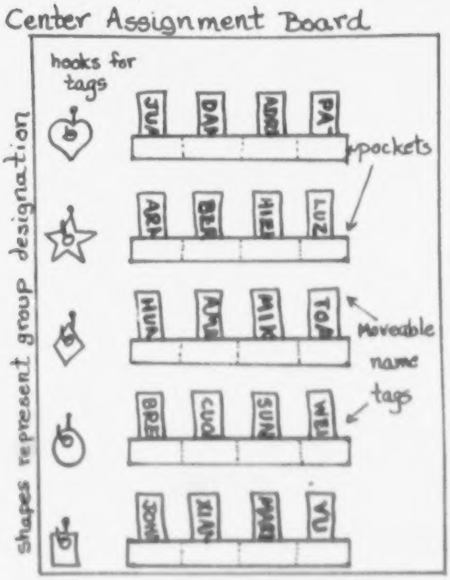


Rotation schedule tag

To rotate groups from center to center, have the groups work in the first learning center assignment for a designated period of time. At a predetermined signal (bell, flickering lights, drum, special record, etc.), the groups move to the next center. Each day a different student can be assigned to give the signal.

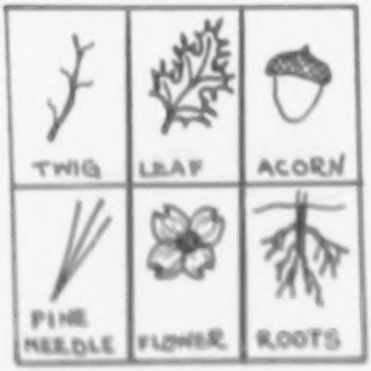
You and any helpers you may have (paraprofessional, parent volunteer, older student volunteer, more proficient student) function as facilitators during center time. Actively observe, interact and assess the students as they work in the centers. You can make a simple skills checklist and use it along with individual conferences to evaluate each student's progress.

Students will also enjoy some opportunities to choose to spend extra time at favorite centers. Keep some of the centers open during free choice periods of the day, or schedule a "choice day" once a week.


Center Assignment Board
hooks for tags
shapes represent group designation
pockets
Moveable name tags
JUA
DA
PA-
ARI
LUZ
MIK
TOA
BRE
SUN
WE
YU

LANGUAGE ARTS CENTER

Grab Bag Lotto

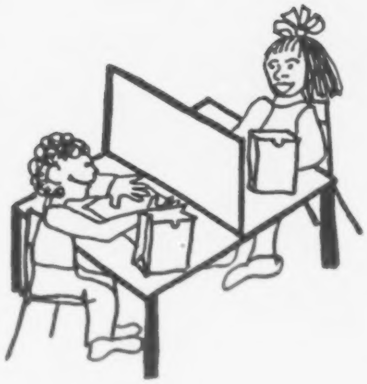

TWIG
LEAF
ACORN
PINE NEEDLE
FLOWER
ROOTS

Materials:

Paper bag containing 5 duplicates of six objects and other assorted objects, e.g., leaves, twigs, etc.
24 - 3 x 5 cards with names of objects (Use pictures for non-readers).
Each object has four identical cards.
4 lotto boards with a different word for each square represented on the cards (see illustration).

Procedures:

Each student draws a card, reads the card and reaches in the grab bag to find the object. The student puts the object on his/her board. The student who completes his/her board first is the winner.



Communication Game

Materials:

2 lunch bags with matched sets of six found objects (leaves, flower, root, etc.).
2 pieces of paper (8 1/2" x 11") with a circle drawn at the top and a triangle at the bottom.
1 piece of poster board to use as a partition.
Written direction cards for readers.

Procedures:

This game is played by two students who sit with a poster board screen between them, blocking vision. One student is "it" and gives the other student directions for putting the items from the bag on the paper while he/she is placing the items in the same position on his/her paper. The directions can be read from teacher-made cards, or can be made up by the direction-giver. When all items are placed, the students compare their papers and discuss the results. The students then switch roles.

Can You Find It ?

Materials:

2 lunch bags with matched sets of textured found objects (e.g., pine cones).

Procedures:

The student who is "it" places his/her hand in the bag and, without looking in the bag, describes the object he/she is touching. The other student feels in the bag to find the object that matches the description. When the guesser is ready, he/she says "I feel it," and they take the objects out simultaneously. When a match is made, the guesser becomes "it."

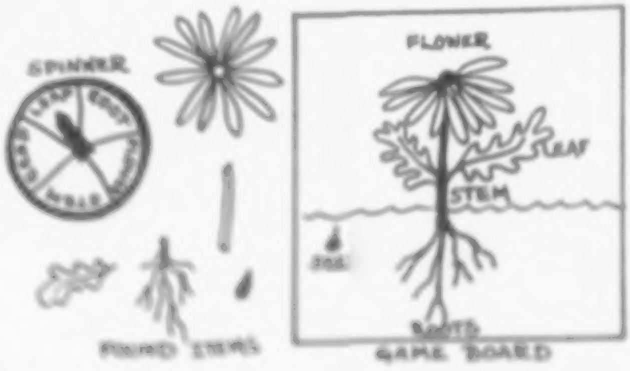
Parts of the Plant

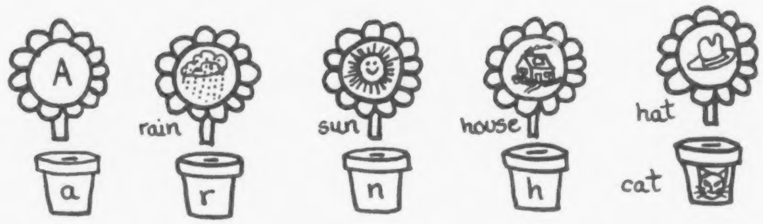
Materials:

4 bags of found materials (leaf, stem, root, seed, flower).
1 game board.
1 spinner.

Procedures:

This game can be played by two or four players. The students take turns spinning and finding the item which matches the spinner word and placing the item on the correct space on the game board. The game is won by the first student who has placed all his/her items on the board.





Flower in the Pot

Materials:

Teacher-made flowers and flower pots (see sample).

Procedures:

Students match capital and lower case letters, beginning sounds with letters, ending sounds with letters, and/or rhyming words by pictures. Students place flowers in the pots. Activities are self-checking, with answers on the back of each flower.

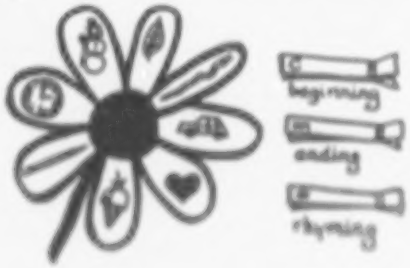
Clothespin Match

Materials:

Large, teacher-made flowers with pictures on each petal (see example).
Clothespins in 3 different boxes.

Procedures:

Students use the clothespins to match the rhyming picture, beginning or ending letter. Activity is self-checking with answers on the inside top of each box of clothespins.



What am I?

Materials:

Picture cards of fruits, vegetables, tree, leaf, flower, acorn, etc.
Safety pins.

Procedures:

1. Introduce the center by reviewing the names of the items on the picture cards. Encourage students to describe the parts of the plants shown, and to discuss the parts of the fruit and vegetable plants that are eaten.

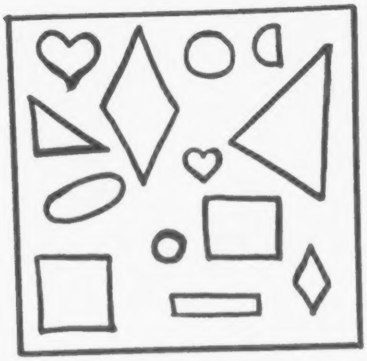
2. Have the students sit in a circle. Choose one student to be "it." Pin a picture on the student's back. Explain that the other students must give clues to what plant or plant parts "it" wears without actually naming the item.

3. "It" must try to guess what is on the picture. Help the students provide hints until "it" is successful, and then give another student a turn. Continue until everyone has had a turn.

Extension:

Have students make their own sets of picture cards so that they can take them home and play the game with family members.

MATH CENTER



Shapes of Nature

Materials:

Teacher-made shape board (a laminated poster board with black line shapes of various sizes, see example).
1 bag of found materials you have selected to correspond to the shapes on the board (e.g., leaves, twigs, etc.).

Procedures:

This game can be played with two, three, or four students. The students take turns picking an object from the bag, telling the name, shape and size of the object and placing it on the board. The game is over when all objects are used.

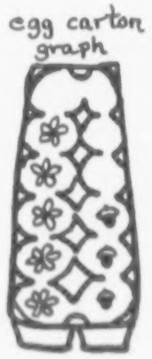
Egg Carton Graphs

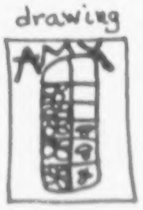
Materials:

2 egg cartons with tops cut off.
2 bags each with 2 sets of objects of different quantities (e.g. 4 pine cones, 2 leaves).
2 bags each with 2 sets of objects of equal number (e.g. 3 acorns, 3 seed pods).

Procedures:

Students can work alone or in pairs placing the like objects together. Students then place like objects in the egg carton starting at the bottom on each side. Students orally interpret the results. They may also draw the graph on paper.





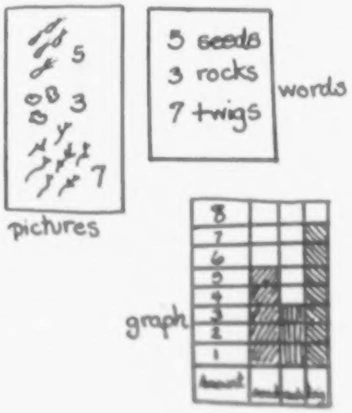
Sorting and Classifying

Materials:

1 bag of found materials (rocks, seeds, leaves, etc.).
Plain paper.
Pencils.
Crayons.
Large-square graph paper, 8 1/2 x 11.

Procedures:

1. In the first part of this activity, students work in pairs sorting and classifying the objects in the bag according to their characteristics. Students record their findings by drawing or writing how many of each object they found.



2. In the second part of this activity, students make a graph of the findings. Using the paper ruled for the graph, the students draw or write the word for each category. The students then record the information by coloring in one squares per object, or drawing one object in each square.

3. After students have completed their graphs, ask them specific questions which require interpretation of the graph such as, "How many more seeds than pine cones did you find?"

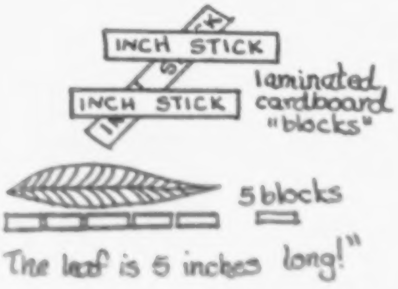
Measuring

Materials:

Meter sticks.
Rulers (with inches and centimeters).
Plastic cube snap blocks or small "Lego" blocks.
Pencils.
Paper.
1 bag of stem, grasses, twigs of various lengths.

Procedures:

Students work in pairs finding the longest and shortest objects. Then the students measure and record their findings, using the units of measure that they best understand. Young children can use blocks or cubes. (Older students might use rulers in inches or centimeters.) The students record their findings by tracing the object on a piece of paper and writing its measurement.



SCIENCE CENTER

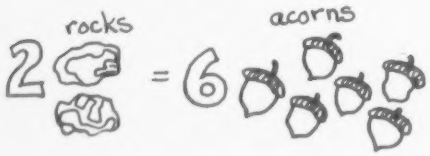
Weighing

Materials:

Balance.
2 paper cups.
1 bag of found materials (acorns, pine cones, etc.).
Paper and pencil.

Procedures:

Allow pairs of students time to explore the balance using the found materials. Then give each student a constant (e.g., a paper cup with 2 acorns) and ask them to find the objects that, when put in the cup on the other side of the balance, will make it balance. Students compare a variety of materials to experience making predictions and then record their findings.



What is Inside?

Materials:

1 jar of large fresh lima bean seeds(soaked overnight).
1 magnifying glass.
Paper towels.
Plastic knife.
Pencil.
Paper.

Procedures:

Have students work in pairs to find what is inside the seed. Given the materials, they must experiment to find the answer. (They will find a tiny plant embryo.) Students make predictions and discuss the outcome. They may draw and write about their findings.

Parts of a Plant

Materials:

One whole plant (e.g., a weed with flower,
leaf, stem, root).
Large teacher-made puzzle of a plant (14 pieces).

Procedures:

1. Introduce the center by reviewing the parts of a plant. Show the students the weed and ask them to point to the flower. While pointing to the stem ask the students if they know what it is called. Supply the terms when there is no correct response.

2. The students put the plant puzzle together. As they find pieces, they identify what part of the plant they found.

Find the Seeds

Materials:

Any seed pods.
Flowers.
Tall grasses.
Fruit (Avocado, apple, orange, tomato).
Vegetables (bean, potato).
Plastic knives.
Potting soil.
Cups.
Water.

Procedures:

Have students find the seeds in the collection of materials and compare them according to characteristics. Students may plant some of the seeds they have found. Ask the students questions about their findings, e.g., "Which seeds are edible?" "Which seed was the biggest?" "Which plant had the most seeds?" "What does the seed need to help it grow?"

Sprouting

Materials:

A large zip lock bag containing wet paper towels.
1 small zip lock bag for each student.
Seeds (radish, mung beans, grass, beans).
Large piece of white paper 8" x 12".
Box full of strips of colored construction paper.
Scissors.
Glue.
Masking tape.

Procedures:

1. Have students place a damp paper towel in a small zip lock bag and sprinkle 3 or 4 seeds in a row (one of each type) and zip the bag closed. Make sure students write their names and the date on the masking tape strip and stick it on the bag. Students may tape the bag to hang from a shelf or use clothespins on an indoor line strung from one wall to another.

2. Ask students to predict which seed will sprout first. You can construct a chart of possible prediction on which the students will write their names under their predictions.

3. When plants grow, discuss and record who predicted correctly.

4. Have students make a graph showing the growth of their first seeds. Each day students hold a paper strip up next to the growing seed to measure it. The students cut the strip to show how tall the plant is that day and paste the strip on a large sheet of paper over that day's date.

ART / MANIPULATIVES CENTER

Waxed Paper Collage

Materials:

Iron (to be used with adult supervision).
Waxed paper.
Old pieces of crayon, stripped of paper.
Found materials (leaves, grasses, pine straw --
all flat items).
Scissors.

Procedures:

Students cut two pieces of waxed paper the same size and place found materials of their choice on one piece of waxed paper. The students shave crayons, with open scissors, on top of the found materials. The students lay the other piece of waxed paper on top of the collage. With adult help, the students insert the project inside a folded piece of newspaper and iron it until the crayons melt and the two pieces of waxed paper stick together.

Rubbings

Materials:

Tape.
Found materials.
Thin pieces of crayon, stripped of paper.
Newsprint paper.

Procedures:

Students tape found materials to the table in a design. Students place a paper over the design and rub crayons over the paper, using the side of the crayon. The rubbing will make a print of the objects.

Pattern Printing

Materials:

Different colors of liquid tempera paint.
1 brush for each color.
Paper.
Found materials (seed pods, acorn tops, bark, rocks, leaves).

Procedures:

Students brush the found objects with paint and press or stamp them on paper to make a pattern.

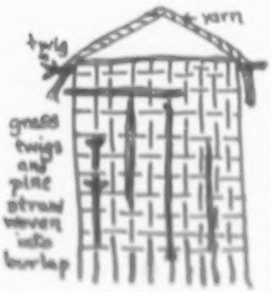
Weaving

Materials:

Colored burlap in rectangular shapes.
Found materials (twigs, grasses, pine straw, etc.).

Procedures:

Students weave found materials into the burlap. When weavings are finished, wrap the top over a twig and glue. Use yarn to hang the tapestry.


yarn
twig
grass twigs and pine straw woven into burlap

Create a Plant Picture

Materials:

Colored paper.
Scissors.
Crayons.
Pencils.
Glue.
Chart of parts of a plant.

Procedures:

To introduce the center, have students help you label the parts of a plant (roots, stem, leaves, flower, seed) on the chart. Display the chart at the center. Students work in small groups of five at the center. To make a group plant picture, each student chooses a part of the plant. The student draws that part and cuts it out. The parts are then assembled and glued on a large piece of paper. The students label their part of the plant and hang the finished product in the classroom.

LISTENING CENTER

The Carrot Seed

Materials:

The Carrot Seed, by Ruth Krauss.
Tape recorder.
Earphones and jack for tape recorder.
Teacher-made cassette tape recording of the story.
Questions about the story, on the tape.
Paper.
Pencils.
Crayons.

Procedures:

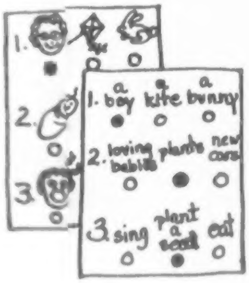
Students listen to the recorded story and answer questions about the story by drawing pictures, writing the answer, or "bubbling in" the answers on an answer sheet prepared by you. You may include on the tape instructions for folding paper into eighths and numbering boxes to make an answer sheet, and for turning the tape recorder on and off to allow time for students to follow instructions.

Extensions:

See the reference list for other books that would be appropriate for the listening center.

Sample questions:

1. Who was the story about?
2. What was the story about?
3. What did the boy do first?
4. What did the boy do next?
5. What did the little boy do every day?
6. Who believed the carrot would grow?
7. What happened at the end of the story?
8. What did you think would happen?



WRITING CENTER

Plant Words

Materials:

Pencils.
Crayons.
Paper.
Seeds in container.
Teacher-made word cards of plant unit vocabulary and picture.
Box of sand (or sand table from kindergarten).
Large pictures of flowers, trees, vegetable garden, fields, etc.

Procedures:

To introduce this center, elicit plant words from students and write them on the cards, adding an identifying sketch. Using the word cards as models, students write the words with seeds in a box of sand. Then students may write the word and draw the picture on a piece of paper. Students may also write or dictate a sentence or story about one of the pictures.

DRAMA CENTER

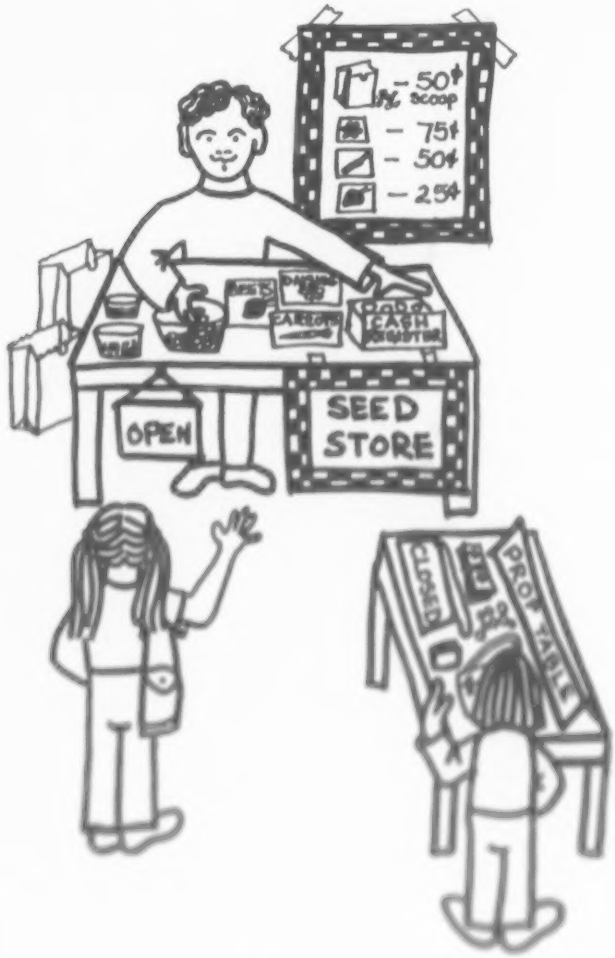
The Seed Store

Materials:

- Sign for "Seed Store."
- Signs for "open" and "closed."
- Picture price list.
- Real or play money.
- Seed packages.
- Different kinds of dried beans in bowls with scoops.
- Cash register sign with pictures of items and prices.
- Old wallets and purses for customers.
- Paper lunch bags.

Procedures:

Demonstrate the roles and interactions for the class before having children use the center. Students play the roles of customer, cashier and clerk as they buy and sell the seeds. The cashier takes the money and gives change. The clerk greets the customer, gets the order, and puts it in a bag. The clerk tells the cashier what the person is buying. The students exchange roles and practice the language used in each of the roles.



COOKING CENTER

Seed Candy

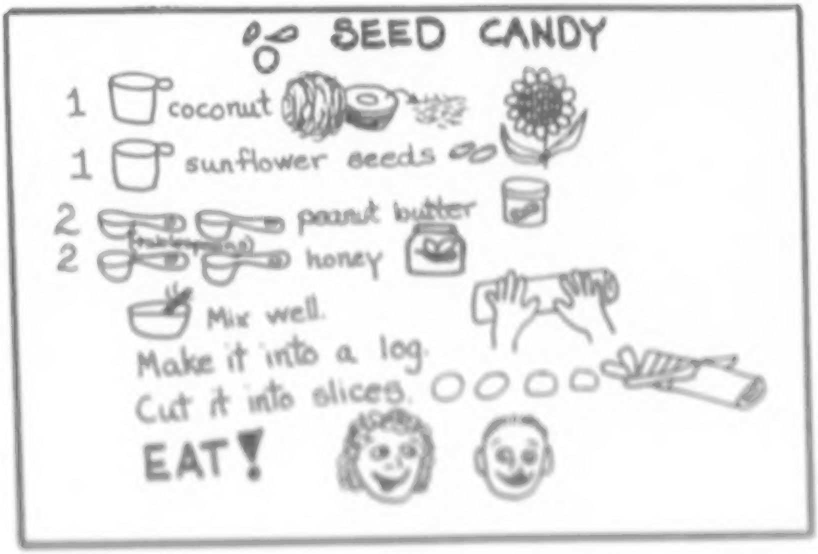
Materials:

- Rebus recipe on chart paper.
- Bowls.
- Measuring spoons.
- Plastic knife.
- Mixing spoon.
- Ingredients for recipe (coconut, hulled sunflower seeds, peanut butter, honey).
- Waxed paper.
- Napkins.
- Paper towels.
- Sponge.
- Dish towel.
- Liquid dish detergent.

Procedures:

1. During the introduction of the center, demonstrate the recipe with a "dry run." Make sure that each student has a role and participates in the cooking. Encourage students to talk about the smell, feel and taste of the candy while they prepare and enjoy it. As students wash the dishes, encourage them to discuss how they help at home, the jobs they like to do, and how proud they are of their accomplishments.

2. Homefun : Students take a piece of candy and a copy of the rebus recipe home to share and discuss with family.


SEED CANDY
1 coconut
1 sunflower seeds
2 (tablespoons) peanut butter
2 honey
Mix well.
Make it into a log.
Cut it into slices.
EAT!

RESOURCES

Benton, William and Elizabeth. (1969). *How Does My Garden Grow?* Racine, WI: Western Publishing.

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Harlan, Jean Durgin. (1976). *Science Experiences for the Early Childhood Years.* Columbus, OH: Charles E. Merrill Publishing Company.

Howell, Ruth. (1970). *A Crack in the Pavement.* New York: Atheneum.

Huntington, Harriet. (1968). *Let's Go To The Woods.* New York: Doubleday.

Krauss, Ruth. (1954). *The Carrot Seed.* New York: Harper & Row.

Rockwell, Robert E., Sherwood, Elizabeth A., and Williams, Robert A. (1983). *Hug a Tree.* Mt. Rainier: Gryphon House Inc.

Scheer, Julian, & Bilek, Marvin. (1964). *Rain Makes Applesauce.*

Silverstein, Shel. (1964). *The Giving Tree.* New York: Harper & Row.

Stobbs, William. (1984). *Gregory's Garden.* Oxford: Oxford University Press.

Records:

Follman, Illene, and Jackson, Helen. (1977). *Science in a Nutshell.* Songs Exploring Science Experiences for the Early Years Preschool - 2. "I'm Going to Plant a Garden," "Walking in the Woods," "Dandelion Seed." (Record). Long Branch, NJ: Kimbo Educational Records.

Glazer, Tom. (1973). *Now We Know (Songs to Learn By).* "How Do the Seeds of Plants Travel?" (Record). NY: Columbia Records.

Palmer, Hap. (1969). *Learning Basic Skills Through Music.* Vol. 1, "Growing Song." (Record). Freeport, NY: Activity Records Educational Activities, Inc.

TERRARIUM TURN-ON

by
Marianne Dunlap Sansom

Unit 4: Grades 4 - 6

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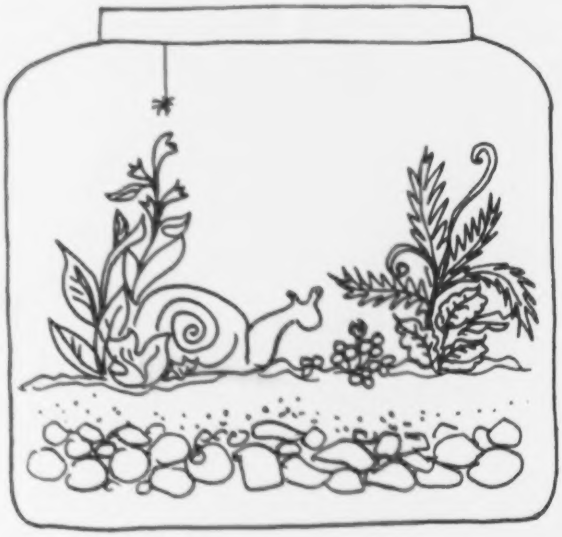
TERRARIUM TURN-ON

What would you say to some fun activities that killed three birds with one stone? Being a good science teacher, you'd say, "Are you crazy? If every teacher killed three birds, the State of Georgia could have an ecological imbalance, and we would be setting a terrible example for our students!" And you would be right. What would you say to a unit full of fun activities that teaches science concepts, math concepts, and helps your ESL students with English and social adjustment? That's more like it. Let's have some fun.

The main activity of this unit is making a terrarium. In this process, students will have a chance to get their hands on mud, sand, rocks, snails, plants and other appealing materials. They will also have the fun of acting out life cycles and snails' walks. They will get to make charts, graphs, pictures and stories. The activities are designed to peak student interest, teach science and math, and encourage the development of language. Because of their active involvement, students will have fun and shared discovery on their minds. This will help students to relax and enjoy acquiring language and science concepts while teachers relax and enjoy conducting interesting multi-leveled teaching activities.

This unit has been developed for English-speaking and limited English-speaking students in grades four, five or six. Students of mixed proficiency levels can be included in all activities.



TERRARIUM TURN-ON
OBJECTIVES

Activities **Objectives** Unit 4 / Grades 4 - 6

1	2	3	4	5	6	7	8	9	**MATHEMATICS**
	●				●				Identifies different names for numbers: whole numbers and fractions (GBC 4, 5,6).*
	●								Compares numbers - whole numbers and fractions (GBC 4, 5, 6).
●	●				●	●		●	Locates points on a grid (GBC 4).
●		●			●	●			Selects appropriate units of measurement (GBC 4, 5, 6).
						●			Determines amounts of money up to $20 (GBC 4).
	●					●			Adds, subtracts, multiplies and divides with whole numbers and fractions (GBC 4,5, 6).
						●			Selects appropriate operations for given situations (GBC 4, 5, 6).
						●			Solves word problems (GBC 4, 5, 6).
●	●	●			●	●		●	Organizes and interprets data in charts, tables and graphs (GBC 4, 5, 6).

1	2	3	4	5	6	7	8	9	**SCIENCE**
		●		●	●	●	●	●	Compares objects by special characteristics (GBC 4).
		●	●	●				●	Recognizes and identifies evidence of interdependence of living things (GBC 4, 5, 6).
●	●	●				●		●	Collects and writes information in tables, charts and graphs (GBC 4, 5, 6).
●	●	●				●		●	Reads information in tables, charts and graphs (GBC 4, 5, 6).
		●	●	●	●			●	Identifies the effects of soil/water interaction; observes rainwater, steam (GBC 4).
		●	●	●				●	Defines water cycle and related weather phenomena (GBC 6).
			●					●	Demonstrates heat and light as change agents (GBC 6).

TERRARIUM TURN-ON
OBJECTIVES

Activities **Objectives** **Unit 4 / Grades 4 - 6**

1	2	3	4	5	6	7	8	9	LANGUAGE
	●	●	●	●	●	●	●	●	Determines meaning of unknown words when heard in context (GBC 4, 6).
	●	●	●	●	●	●	●	●	Uses conventional language patterns (GBC 4).
	●	●	●	●	●	●		●	Recognizes explicitly and implicitly stated main ideas, details, sequence of events and cause-effect relationships (GBC 4, 6).
	●	●				●	●	●	Makes generalizations and draws conclusions (GBC 4).
	●	●				●	●	●	Makes predictions and comparisons (GBC 4).
●	●	●						●	Recognizes the relevance of data (GBC 6).
●	●	●				●		●	Reads and interprets different types of material: books, newspapers, charts, graphs and tables (GBC 5).
	●	●			●	●		●	Interprets basic instructions and labeling information (GBC 5).
	●	●	●	●	●	●		●	Demonstrates understanding of specialized vocabularies relating to subject areas (GBC 6).
		●	●	●	●	●	●	●	Selects appropriate word usage (GBC 4, 5).
			●					●	Summarizes information from a variety of sources on one topic (GBC 4).

1	2	3	4	5	6	7	8	9	ART
●			●	●				●	Creates artworks using a variety of color, shapes/forms, sizes, textures, and space arrangements (GBC 4, 5, 6).
				●					Creates artworks by overlapping objects and by making objects smaller and higher on the picture (GBC 4, 5, 6).
				●					Generates creative ideas through experimentation with different art materials, tools and techniques (GBC 4).

1	2	3	4	5	6	7	8	9	PHYSICAL EDUCATION
●								●	Performs basic locomotor skill combinations (GBC 4, 5).
●								●	Participates in individual, partner and group games (GBC 4, 5, 6).

*Georgia Basic Curriculum Objective for cited grade level(s).

Science Fun Chart

	Rock Hunt	Terrarium	Drama	Art Collage	Collection Da.	Assembly	Snail Day	The Big Review
Names								A SNAIL STORY
Terry								
Steve								
Aaron								
Susan								
Joe								
Tamica								
Farzaneh								
Jason								
Rico								
Nhan								
Clair								

7. SCIENCE FUN CHART

The Science Fun Chart is one of the charts that will go up on your bulletin board as part of this unit. It is an example of how you and your students can record data. The chart previews the unit for students who will appreciate the security and excitement of knowing a little bit about what is coming next. The chart will also introduce activities in reading and using charts by keeping a simple record of accomplishments, and will give the students motivation and confidence to tackle the more difficult charts later on. It may even encourage school attendance!

Procedures:

Large group, teacher directed
Small groups

1. Explain the chart. Note that the Science Fun Chart and the Vocabulary Chart both list the names of all the students, but names are listed in opposite orders on the two charts. This will help students learn to read one another's names without order cues. Besides, those students at the end of the alphabet like to be first once in a while.

2. Each day as students complete the activity for the day let them tape symbols up on the chart beside their names and under the name of the activity.

Evaluation:

This chart will help you to keep a record of who has completed activities. Notice students who miss activities and get behind, and provide special help (perhaps a peer).

Extension:

You may wish to let students who finish an activity early help you to make the symbols for the next day.

Materials: Science Fun Chart on Poster Board (see sample on page 4-6).
Cutouts to symbolize activities (see sample on page 4-6)

2. ROCK HUNT

This activity will kick off the unit, building in an element of suspense. Instead of starting with a straightforward explanation from the teacher, the unit begins with a fun physical activity -- the Rock Hunt -- which will peak interest and launch the students into the world of graphs and charts. The Rock Hunt will also help to create an open environment for language exchange and to introduce three types of graphs: picture, circle, and bar. Each student will have a chance to make a graph of each type.

Procedures:

Large group, teacher directed
Small group
Individual

Preparations:

1. Put desks in groups of four or five or plan to seat students four or five to a table.

2. Have posters on a bulletin board under a big sign that says "DATA COLLECTION CENTER." Do this before students arrive.

3. Divide 100 stones into groups of 2, 3, 4, or 5. Put the stones in bags, tie neatly and place them in nooks and crannies all over the classroom.

4. If students notice a hidden bag or ask about posters, wink and say only what's necessary to keep the treasure in place until the game begins. Try to build curiosity.

The fun begins:

5. Give each student a jar labelled with his or her name. Tell the students that over the next two weeks they'll have fun filling the jars. Ask them if they can think of anything that would fit in the jars. Discuss size and shape. Encourage language.

6. If the students mention the bags of stones, begin the game (or begin when the discussion lags). Have each student find one bag and bring it back to empty into his or her jar.

7. Have them scramble to find the rest. Encourage language as they go. "Oh, Hung has three bags!" "Do you have any Cindy?" etc.

8. After the search, count the stones in the jars. Give a prize to the one with the most stones, if you like.

9. Record your data on the picture graph. Ask a confident student to come to the "Data Collection Center" and find his or her name. Beside the name, let the student draw as many little stones as he or she found. Continue having students record their results on the graph.

Materials:
100 small stones.
String or ribbon.
Small plastic bags (20 - 35).
Scissors.
Construction Paper.
Glue.
Markers or crayons.
Jars (one for each student - our cafeteria saved enough large glass jars for everyone in the class).
Three prepared posters (see samples - large versions of blackline masters).
Prepared student copies of blackline masters (see samples).

10. Discuss the graph. Ask students how many stones different students found. Ask if the chart has data for each one. Ask if it's easy to understand. (Pictures will be of different sizes.) Suggest that other ways of recording data are even easier to understand.

11. Call on students to help you fill in the circle graph. Have each pick a color and fill in sections of the graph to equal the number of rocks collected.

12. After the graph is filled, ask questions about the graph, e.g., "Linda, how many stones did Jay find?"

13. Make filling in the bar graph a class project.

14. After all three graphs are complete, have the children work in small groups to make a picture graph, a bar graph, and a circle graph. Students can use data from the group for the picture graph. Encourage them to help each other. Did you place native English-speaking students and LEP (Limited English Proficiency) students in mixed groups? Good idea! Have students cut out little bags or "stones" and paste them in place. Always put fewer scissors and bottles in a group than the number of students, so that they will have to communicate to share, e.g., "Please pass the glue." "Thank you."

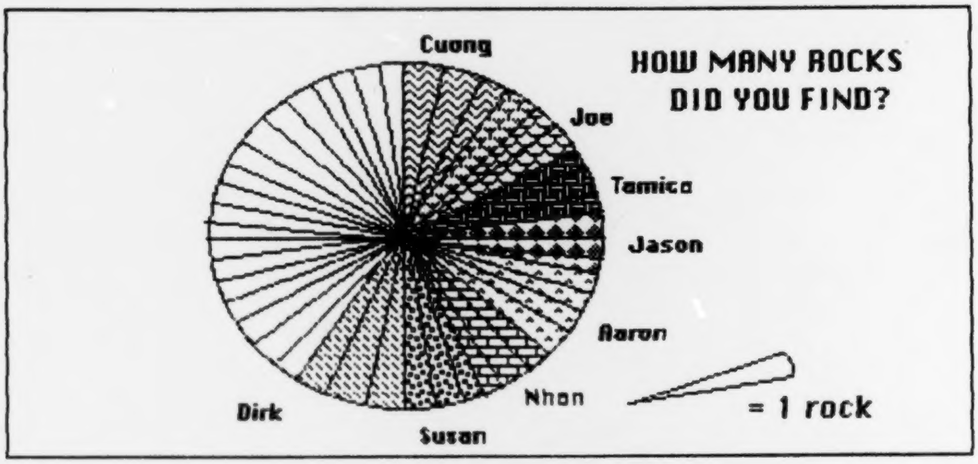
Evaluation:

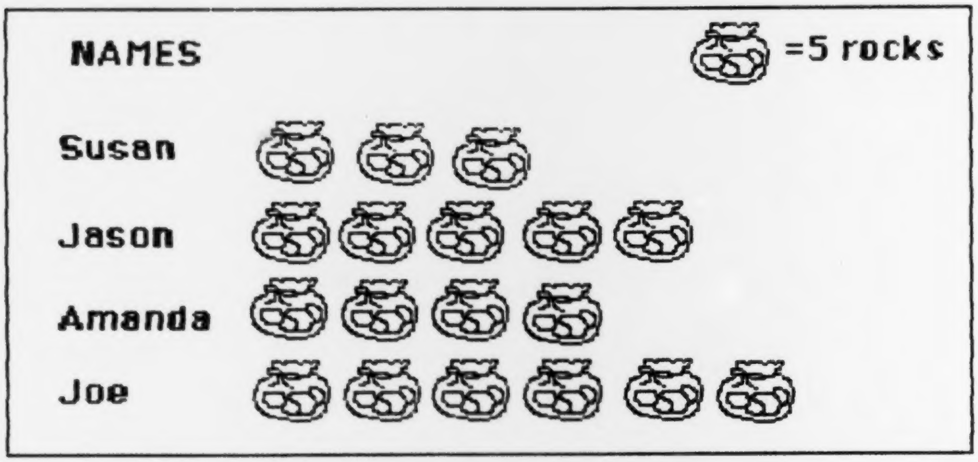
The students should have completed three graphs on their own. Have extra copies on hand for students who need to correct errors. By working in groups, students will observe and check one another. You should circulate among students and discuss work in each group. Check for comprehension. The graphs will show you whether students have grasped the lesson content.

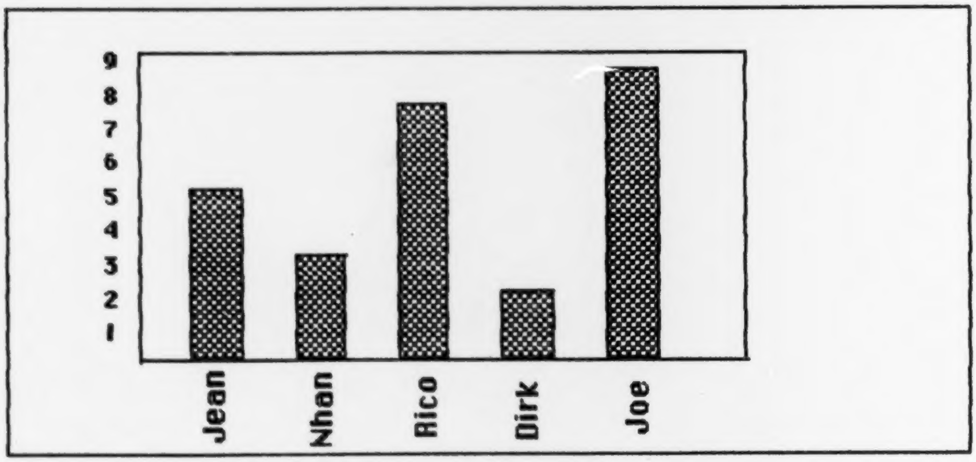
Extensions:

1. Return to the circle graphs and talk about "one hundredth" of the whole circle, to lead into a discussion of percentage. Ask lots of oral questions about the hunt. "What percent did Joe find?" "What percent did your whole group find?" "Can you add percents?" "Tell me who has a larger percent, Hugh or Thuy?" "Rico, who has the smallest percent? That's right," etc.

SAMPLE OF POSTERS



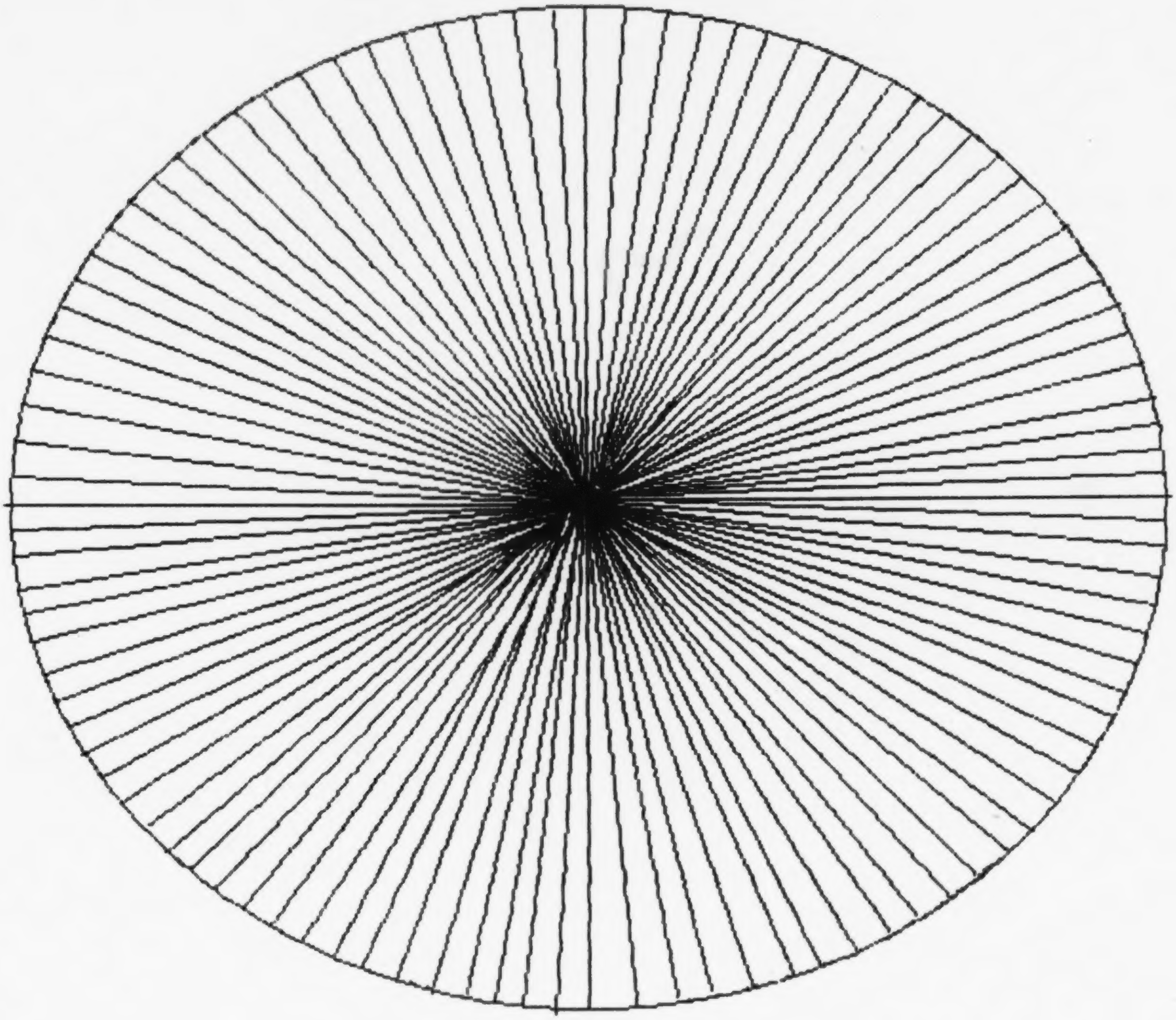




PICTURE GRAPH

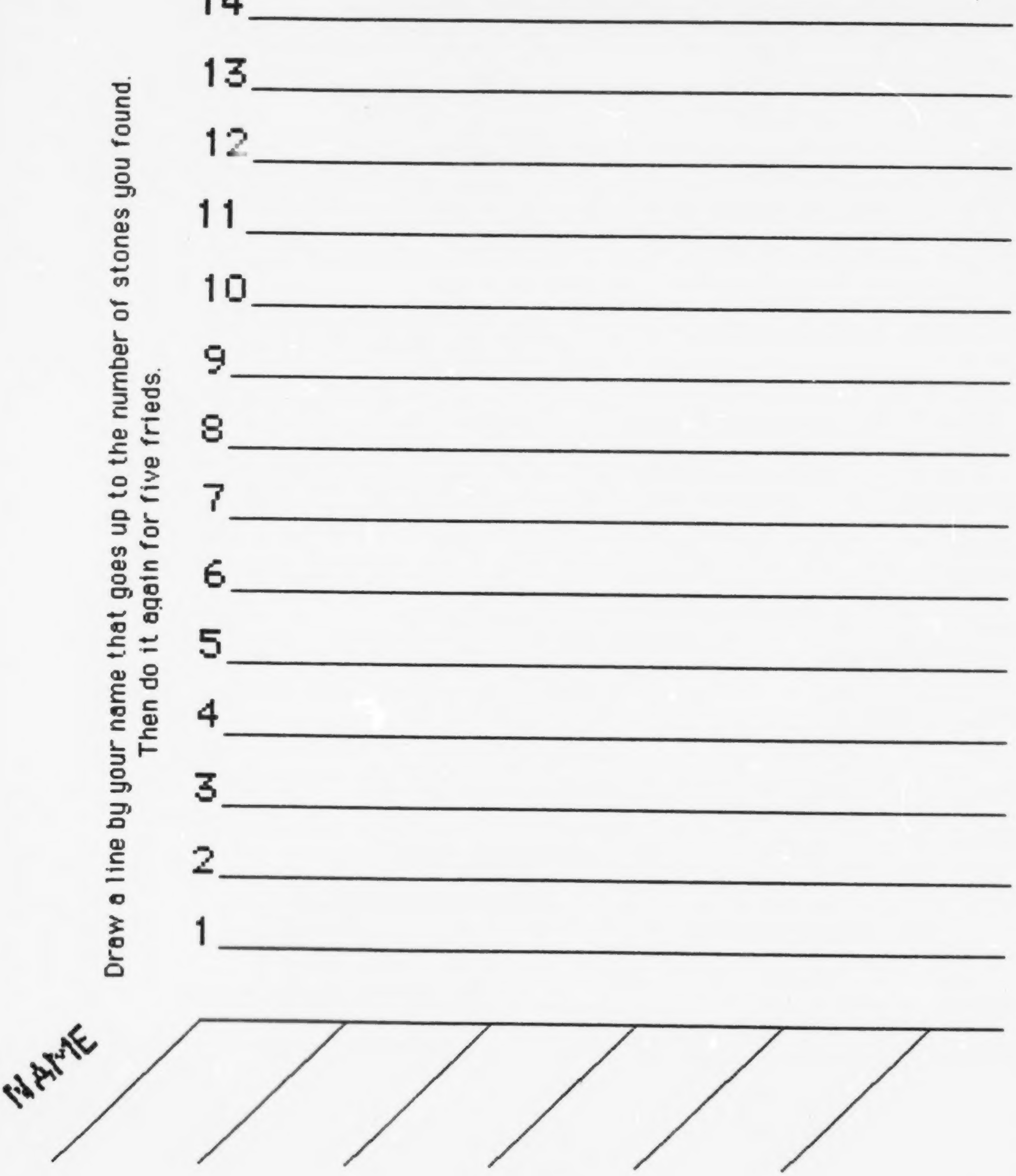
NAME	PICTURES

CIRCLE GRAPH



Color pieces of the circle to show how many stones you found. Use different colors to show how many stones your friends found. Write names outside the circle and use arrows to show which circle pieces go to each name.

BAR GRAPH



Draw a line by your name that goes up to the number of stones you found.
Then do it again for five frieds.

Vocabulary Chart

Select the words that you think are most important to your presentation. Age level and focus will effect your choice.

VOCABULARY CHART

NAME	Terrarium	cycle	photosynthesis	oxygen	sunlight	carbon dioxide	water	air	roots	chlorophyl	condensation	energy	respiration	soil	precipitation
Jean	◤									◢				■	◢
Cuong		◢		◢				◢				◤			
Hung									◢						
Clair									◤				◢		
Nhan						◤									◢
Rico								■					◤		
Amanda		◢			◢	◤								◢	
Dirk		◢													
Jason	◤						◢		◤			◤			
Farzaneh				■		◢							◤	◤	◢
Tamica										◢					
Joe		◤		◢				◢							
Susan	◤	◢		◢										◢	
Aaron					◤	◤			◢						◤
Steve										◢	◤				◤
Terry	■		◢	◢					◢			◢		◢	

◤ I said it !

◢ I heard it !

Let the students check off words as long as the unit continues.

3. TERRARIUM TEASER

To heighten student interest, tell them that during this unit they will get to fill their own jars with little ecosystems. We hope someone asks, "What's that?" This lesson will explain how the terrarium keeps plants and animals alive. It will introduce new vocabulary and science concepts. The vocabulary chart and the promise of making a terrarium will be sure to hold the interest of the students.

Procedures:

Large group

Preparation:

1. Decide which key words and concepts you will focus on. Keep a list of key words beside you as you proceed to make sure you use them all.

2. Have students sit in a semicircle around a table or desk near the bulletin board (Data Collection Center). You will be demonstrating and writing on a poster on the board.

3. Begin by saying that the jars will be used to make terrariums. Write the word "terrarium" on the vocabulary chart. Ask what a terrarium is. Field answers and expand correct ideas. Gently correct any erroneous ideas.

4. When you or a student use a key word, write it on the vocabulary chart. Explain its use later. For now, just make sure the words are posted as they are used.

5. Discuss the water cycle that is created in the terrarium. Encourage discussion on the water cycle in our Georgian environment, including concepts of rain, rivers, water table, evaporation, etc. Ask, "Do we share water with plants and animals?"

6. Discuss the air. Ask, "Do we share the air and the sun?" Discuss photosynthesis and the cycle of oxygen and carbon dioxide. It's exciting to learn how we share air, for example. "Did you know the plants have to breathe, but they don't use the same part of the air we do?" Continue with your explanation. Make it sound wonderful and amazing (because it is!). Keep student involvement high by asking questions and encouraging comments.

7. When you feel you have done well with your group discussion, begin an experiment. Put out the three extra jars.

8. Show students soil, sand, stones, gravel, plants and water in a pitcher. Tell them you want to make a good home for the plant. Ask for suggestions as to how you might layer the soil, sand, stones and gravel to make the plant happy. Accept suggestions. Call on each student for some idea.

9. Settle on three different layering theories, e.g., soil, sand, stones; sand, stones, soil; and stones, sand, soil.

10. Have the students set up each suggested sequence in a jar. Have different students add different items. Fill each of the three experimental jars differently.

Materials:
Vocabulary chart (see sample on page 4-14).
Medium and small stones.
Sand.
Sail.
Weeds and moss.
Measuring cups.
Snail.
Plastic wrap.
Rubber band.
Water in a pitcher.
Large jar.
Three medium-sized jars.
Gravel.

11. Finally, experiment. Add the same amount (say 1/2 cup) of water to each jar. Three different students should participate in this phase of the experiment.

12. Observe and discuss results. Which is the best home for plants?" Lead students to the conclusion that the best layering is larger stones, gravel, sand, soil, plants!

13. Now proceed to make a sample terrarium. Tell students to watch carefully, because they will get to make their own in a few days. Have a different student add each item, and talk about each item as it is added. "The sand is soft; the soil is muddy or grainy; the water is cool." Try to have each student do something, e.g., put in five rocks, measure water, or pour water. When the students finish, applaud the group effort!

14. By now all your key words are on the chart. Direct the attention of the group to the chart. Explain that you hope all the students will use the words on the chart. They will get to record their own words. If they use a word and a friend hears it, they each get a triangle. The one who hears the word will get to fill both triangles. Any time during science class students may go to the Data Center to fill in triangles. You may wish to give incentives to start things off. For example, each student who fills in 10 triangles (or 15 or 20) might receive a special plant for his or her terrarium.

Evaluation:

The science concepts introduced in this activity will be reinforced and evaluated in activities that will follow. The vocabulary words are self-evaluated. They will filter into the students listening, speaking, and reading vocabularies as they continue checking off the chart throughout the unit. They will appear in written work towards the end of the unit.

Extensions:

This lesson asks for a lot of concentration. You will need to judge how well students are absorbing information and avoid over-kill. Keep additional activities minimal, but ride the wave if excitement is high.

1. Have charts or picture diagrams of cycles that students can take home to color.

2. Discuss the different ecosystems here in Georgia. Have students make pictures of woodlands, mountain lands, bogs, marshes, swamps, or semi-aquatic ecosystems. Georgia is a state wonderfully rich in diverse ecosystems.

4. THE PLAY'S THE THING: DRAMA DAY

Students have heard an explanation of how a terrarium maintains life, but they probably have not internalized this information. By acting out the cycle involved, the students will have a chance to understand the exchange of chemicals and the cycles that keep our interdependent earth humming. This activity starts with teacher's directions but becomes student directed.

Procedures:

Large group, teacher directed
Small, independent groups

1. Using the full group, select a first cast of players, and have the rest of the class serve as audience. Have the "sun" don the rays and ascend to a chair standing gloriously above the others. (You may wish to give this honor to a shy child who needs confidence.) Have the "plant" root itself in the soil and bedeck itself with leaves. Keep extra leaves and tape nearby. Have the "bunny" put on ears and wiggle its nose.

2. Of course the sun is the energizer. The sun sends energy to the leaves. Have the sun make a funny energy move that the leaf can copy to show that it has the energy and is involved in photosynthesis. The leaf takes a card labelled carbon dioxide from the "air," pretends to suck in some water and minerals from its roots in the soil, and from these sources adds a new leaf and gives oxygen (turning the card over) back to the air. Now the bunny hops by and takes the oxygen with a big breath and nibbles on the leaf. The "bunny" turns the cards over and gives the carbon dioxide back to the "air."

3. This play can be acted out without talking so shy students will be willing to try it. The first time through you may wish to tell the story while students have fun acting it out. Then get a new cast of actors and have a student be the storyteller. Continue to take turns acting and telling.

4. Before interest wanes, stop the play and give the students a picture of the oxygen/carbon dioxide cycle. Have them fill in the words and color the pictures.

Evaluation:

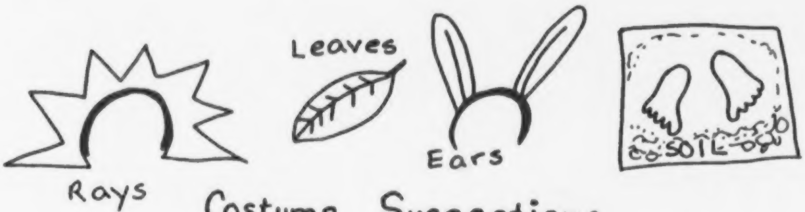
Each narrator will display his or her understanding of the cycle of events as the telling of the story proceeds. To check the understanding of other students, go around and look at their pictures. Those pictures are really "fill in the blank" tests. You can make them more demanding by providing less information, or easier by listing an "answer bank" of terms on the board.

Extension:

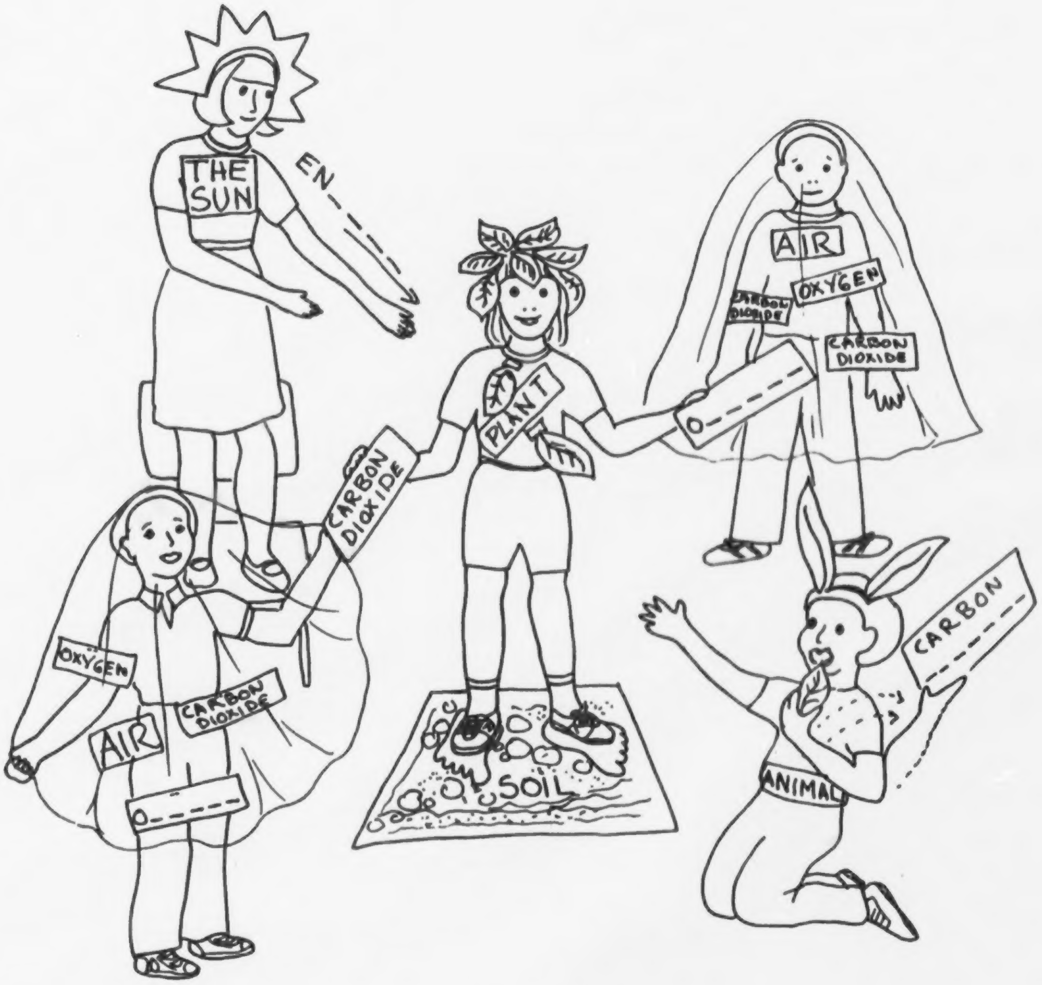
Make another play showing the water cycle in the terrarium. Act out temperature changes, condensation, precipitation, etc.

Materials: (Students will enjoy helping to make props.)

Costumes:
  Sun: plastic headband with paper rays.
  Plant: plastic headband with real or paper leaves.
  Animal: plastic headband with paper bunny ears.
  Air: blue or white net "veils."
Props:
  Soil: poster board with drawings of dirt, water and two footprints.
  Paper leaves with attached tape - or perhaps a stapled leaf necklace
  Straight pins
  10 index cards, "oxygen" on one side, "carbon dioxide" on the other
Duplicated blackline master of the scene


Leaves
Rays
Ears
SOIL

Costume Suggestions


THE SUN
EN----
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AIR
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SOIL
CARBON ------
ANIMAL

THE PLANT CYCLE

5. TERRARIUM COLLAGE

By making collages, students will have a chance to review assembly procedures before they get their hands on their real terrarium materials. This art project will also provide a fun, relaxed atmosphere to encourage oral language use. Your encouragement and acceptance will help all the students feel good about their efforts.

Procedures:

Small group, individual

1. In this activity, students will work cooperatively in small groups to produce individual results.

2. Draw a large scale outline of a jar on the board.

3. Working from the bottom of the jar on up, have students take turns showing what the steps are in the construction of the terrarium. (See sample below.) Have them draw on the board and label their contribu-tions. They may want to sign their work.

4. Have students make their collages. Suggest that they cut out and practice positioning their collage pieces before they actually apply the glue.

5. Circulate among students to ask questions and to encourage interaction. Compliment student efforts often.

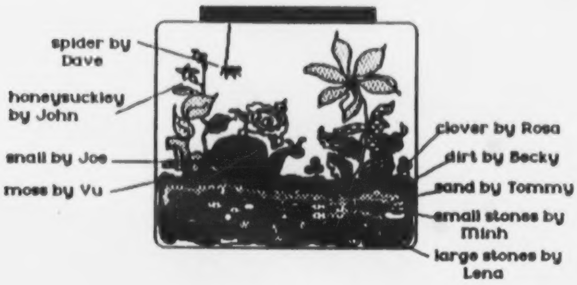
Evaluation:

This activity graphically shows you how clearly each student understands the construction of the terrarium. Always have extra materials and cardboard around in case of disaster. (For example, if the student places the plant under the sand, you'll need another plant!)

Extensions:

1. You may wish to have a few special items that a student who finishes this terrarium early could distribute to other students. For example, should Beth finish first, have her take some clear sequins around to other students. The sequins could be used to show water. They could be added to the soil, hidden in the rocks or condensed on the lid at the top.

2. Give awards to students for wonderful work. The awards might be little fake rubbery insects or worms to be glued on the collage. Have as many awards as students. Give each award for a different honor: best use of color, happiest snail, best sand, most stones, etc.



Materials: Scissors (one less than number of students per table).
Glue (one bottle per five students).
Crayons.
Swatches of fabric (Hawaiian prints for leaves, grey felt for rocks, blue felt for water, etc.).
Magazines (to cut up for pictures of plants, sand, soil, etc.).
Cardboard squares (four to a poster board -- each with an outline of a jar on it).

6. COLLECTION DAY

In collecting plant life for your terrariums, make sure you do not decimate the school yard, the forest or Dad's garden. Carefully structure the collection activity. Even weeds are part of the ecosystem, so help the students proceed with caution. Some of the collecting will be done at school, but other items can come from home. If many of your students are apartment and city dwellers, get in touch with a nursery, plant shop, or the city park and ask for cast-offs or inexpensive plants and skip the Homefun activity. Although cities don't always abound in plant life, we are lucky in Georgia. Even our largest city is known for its greenery. And right in the heart of the city, green plants, trees, weeds and, yes, even poison ivy, grow abundantly.

Procedures:

Small groups

Preparation:

1. Check with the ground crew at your school. Ask where there may be weeds that need to be cleared. Clover may not be appealing beside the flag pole, but it will be charming under glass. Ask permission to remove a little moss from a tree trunk. Scout the territory before you bring on the troops. Know the location of poison ivy!

2. On Collection Day, write this poem on the board. (It came from an environmentally aware teacher from my elementary school days.)

Pick, if you must, one flower face,
If nine more are left in place.
Two feet square must hold this many.
Otherwise, look and don't pick any.

Author Unknown

3. Have fun with the poem. Try choral reading, assigning lines, reading in pairs, memorizing one line only, acting out while you read, etc. After a few minutes the poem will probably be memorized. Encourage students to and follow its rule.

4. Preview the field trip. You will be identifying (but not touching) poison ivy. Newcomers to Georgia may not know how important it is to know about this mean vine. Explain that where you find moss (on the northern side of a tree trunk) you will try to take only a tenth. When you see weeds, you will take them all (if the ground crew has approved). Where you see other weeds, you will apply the rule of the poem. Count ten, take one. Remember, you need to remove roots!

Field Trip Procedures:

5. Collection begins. If you have an aide and/or parent helpers, assign each adult to a small group of students. If you are on your own, as usual, enjoy the whole crowd. Check out poison ivy first. Explain that the oil on the leaves produces the rash. Move on to known locations of dandy specimens. Apply the advice of the ground crew to weeds and where you see other specimens apply the rule in the poem. Only take weeds. Have students go about in groups of four. When each student has a bag with something in it, return to the classroom.

6. On the way indoors, stop by the restrooms for serious hand washings with soap and water, just in case a few of the students have closed in on some poison ivy.

Materials:
Plastic bags.
Digging tools.
Shallow pans.
Potting soil.
Toothpicks.
Paper.
Reference books for plant identification.

After the trip:

7. Once in the classroom, you can identify and classify your plants. Using reference books when necessary, make a picture graph on a poster board to show how many specimens you have of each type (five patches of moss, seven little clover plants, four small clumps of honeysuckle). Post the graph.

8. Put students' names on toothpick flags and label the specimens as you plant them overnight in the shallow pans which serve as holding tanks.

9. Homefun: Preview the Homefun activity with the students. You may wish to make individual copies of the guidelines. Ask students to solicit the help of their parents in selecting weeds for their terrariums. This is a chance for parents to get students to weed flower beds! Make sure that they do not go to the woods and rob Georgia of its wildflowers and rare ferns! The wild strawberries growing in the vegetable garden, the clover, the crabgrass, and the dandelions will be fine specimens. Suggest that students bring their plants to school in plastic margarine tubs or old peanut butter jars. (If you send homework lists home at the beginning of each unit, send word about this Homefun activity and have students bring in their finds over the first four days of the unit.)

Evaluation:

This activity really does not bear a rigid evaluation approach. You can consider yourself successful if there are no poison ivy rashes on fingers, no gardens damaged, and no students without some green plants. It is such a joy to see how students truly love nature. Just calling a dandelion one's own can bring a smile to a child.

Extensions:

1. In an urban environment, a prearranged trip to a nursery that has supplies of left over or damaged plants would be great fun.

2. Buy some plants from a local store or from the local Extension Service. Little plants are not expensive. (Can you use P.T.A. funds?) Have a plant auction in class. Students may bid favors or services. "I'll bid three waste basket emptyings!" "I bid four trips to the office to carry messages!" "I bid one picture to use as a get well card for the cafeteria manager!" Students love to do these things anyway, but this will be a great chance to encourage language use and creative thinking.

3. Use the poem as a handwriting exercise.

7. TERRARIUM ASSEMBLY

This activity is the big event! Students will get to utilize all they have learned in the unit. They have watched terrarium assembly and constructed one on paper, but to insure that they work carefully, they will be working with a partner. This activity includes math (measurement), science (layering the components of the terrarium), and lots of language (listening to and giving directions), as well as charting and graphing.

Procedures:

Large group, teacher directed
Pairs, teacher available

1. Begin with Show-and-Tell. Have students show the class what they found at home. Encourage as much telling as is possible. New English speakers will need help identifying their terrarium parts or remembering the names we give them.

2. As a group project during show-and-tell, make a bar graph of the varieties of plants, similar to the previous picture graph. Ask a couple of capable students to make one for the class on a poster board while each student makes his or her own. When all the students have finished, post the graph and have students save theirs in their folders.

3. Measuring. Assess the size of the jars and the amounts of each component that will be appropriate. Write the amounts on the board as you proceed. Ask what will go on the bottom, e.g., "The bigger of the two sizes of rocks?" "Yes. One cup of these stones." (Demonstrate.) Write sequence and amounts on the board as you go. Let the suspense build. Children will want to get their hands on those measuring cups!

4. Assembly. When the instructions on the board are complete, divide the students into pairs. Distribute plants. Make sure additional plants are on hand. Now for the teacher's trick: each student will make the other student's terrarium according to "blow-by-blow" directions. (This is not the day to let enemies work together.) Students may not touch the insides of their own jars. They may only tell their partner what to do. If you wish to demonstrate this, have a student tell you what to do. (They love to teach the teacher.) "O.K. Ms. Educator, put one cup of these stones on the bottom ... Now put one and a half cups of the little stones on the top of them ..." Suggest some words that will be helpful for the placement of plants such as "in the middle," "to the left," "beside," "near," "between." When all the students understand your instructions, turn them loose. Circulate among students to troubleshoot and to enjoy the fun.

Evaluation:

The charts, graphs, and terrarium are data that show how well the students are absorbing the unit vocabulary and concepts.

Extension:

After the terrarium assembly, have students use the data recorded on the board to make picture graphs and bar graphs to show how much of each component was used.

Materials:
Large jars (you already have them labelled).
Medium and small stones.
Sand.
Potting soil.
Plants.
Water.
Measuring cups.
Prepared charts and dittos.

8. SNAIL DAY

Not everyone has a ready supply of snails in the back yard, so a few P.T.A. funds may need to be diverted to obtain some. But what fun the snails will be! They are fun to watch and easy to care for. Each of the students should have a living animal creeping around in a terrarium. Today's activity puts the students in the snails' shoes. What shoes? What feet? What fun to observe an animal so unlike ourselves. Observation, comparison, imitation, projection, and fun are key objectives of this activity.

Procedures:

Large group

1. Observe and discuss the snail. Put a snail in a small open jar with a little water and some green leaves. Invite students to observe.Watch quietly for a while, then begin to ask open-ended questions that encourage children to talk and that require observation and higher-level thinking, such as:

"What is that body like? A worm?
A chewed gummy bear?"
"What is the shell like? A thimble?
An acorn?"
"What would it be like to live in that
shell?
"Can you make a mouth like that?"

2. Snail Action. Judge when interest begins to wane and put the snail away. Have students push back the desks and sit in a circle on the floor or go outside. Ask them who can make a snail face. Call on more confident students to get the ball rolling but also include new English speakers. Ask students what snails do with their hands. What hands? Ask students to demonstrate, one at a time, how snails move.

3. Divide students into two "snail" teams, and have snail relay races. For example:

Crawl a course (e.g. around a chair and back) with a box on your backside. You may not use your hands to keep the box in place as you crawl, only to replace it when it falls off.

Lightly tie hands and feet with rope or rubber bands, and have a crawling relay.

More daring students may wish to try a race in which their hands and feet are tied, and they carry a box on their backsides as well. Anyone who can move at all gets a prize!

Have students invent snail races,or pretend to eat like snails.

4. Sit in a circle and talk about what it was like to be a snail. Is it better to have arms, hands, legs and feet? Why? Explain. Hand out prizes. Snail food? Green leaves: mint leaves, lettuce, etc.? The real prize is, of course, a snail. Each student may choose and name a snail and put it in his or her terrarium.

Evaluation:

You may wish to evaluate yourself. Did you encourage higher levels of thinking? Did you encourage all members of the group? The games, they are for enjoyment and to help your LEP students become part of the group. No formal evaluation is needed.

Extensions:

1. Take a field trip to the pet store to buy the snails. Each student could have a task: carrying the money, talking to the cashier, counting the snails, etc. You could count other animals and make charts and graphs of the data collected. Pick favorite animals and have students draw pictures of them. Write a thank you letter to the store. Go home and beg for a puppy.

2. Whether you go to the store or not, you can create a Homefun assignment that includes word problems about buying snails, e.g., "How much does one cost?" "How much did Mr. Educator pay for 21 snails?" "How much tax did he pay?"

Materials: Snails.
Cotton rope or ribbon.
Large cardboard boxes.
Play clothes (tell students to wear action clothes).
Mint leaves, lettuce (optional).

9. THE BIG REVIEW

To review and evaluate the material in this unit the final activity involves a written summary of the terrarium building project. It is a large group language experience activity. This way, even your LEP students will be able to write up their experiences. Science, math, and language concepts, unite!

Procedures:

Large group and individual

1. Have the students put their terrariums on their desks. Have them watch their snails, and observe the water formed by condensation on the lid of the terrarium. Write a title on the board: How We Made a Snail's Home.

2. Help students with a glorious language experience exercise to recall all things that went into the terrarium. Students may write their own statements or you may write them for students. Ask leading questions in order to get science concepts on the board. After all the statements have been made, have the group put numbers on each statement to show the correct chronological order. Take turns making suggestions. If you write the statements up on chart paper, you can physically cut them apart and paste or tape them into the proper order.

3. It will take patience, but allow students to fill in the vocabulary chart as you go. To signal that a child has heard a vocabulary word, he or she must raise a hand and open and close it quickly twice. Then the teacher can let the first to signal receive credit and record the words. Any shouting out costs the student the chance to claim the word.

4. When the review is completely recorded and numbered, let each student copy the correctly ordered story for the plant folder.

5. Make a joyful picture of a favorite part of one of the activities. Collect all the personal graphs, collages, etc. and have the students organize their own work into a book. Include the snail's story. Use the collage as a cover and staple the book together.

6. Homefun: Send the book and the terrarium home to be shared with the family.

Evaluation:

7. Have the students take out paper. Go to the completed Data Collection Center, and as you clear it, ask questions about the graphs and charts. Have students number their papers and record their answers. By asking oral questions, you can monitor the faces of the ESL students to check for comprehension problems. Prepare questions tailored to your group. Ask questions such as:

Who got the largest percentage of rocks?
How many types of plants did we use?
What students who used more than seven words on our Vocabulary Chart?

Extensions:

1. Write a story about a snail. What adventures did Snail have before joining us at school? What do Mommy and Daddy snails teach babies? Do they have trouble learning to "walk?" Do they like the taste of algae? Students might even turn the snail into Super-Snail, and create a comic book page about the Snail hero.

2. Select a special person at home to whom the terrarium will be given. Make a beautiful greeting card and write a an accompanying message.

Materials: Chalkboard and chalk.
Data Center.
Paper and pencils
Crayons

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ADVENTURES IN ARCHITECTURE

by
Susan Putzell

Unit 5: Grades 4-6

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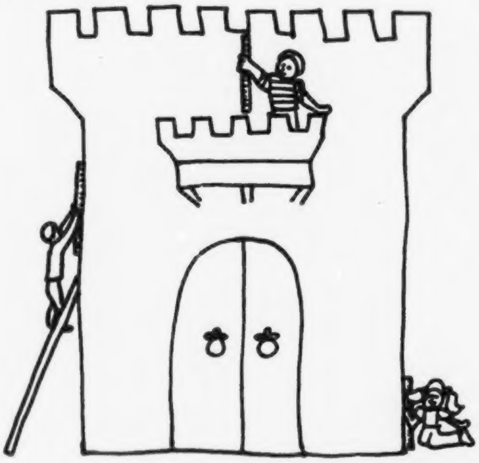
ADVENTURES IN ARCHITECTURE

Children are natural builders. Activities in this unit will sustain and direct in elementary students the curiosity which motivates a four year old to build the tallest tower or the perfect marble roll. While playing and experimenting with building, students will gain an understanding of the physical and mathematical principles that explain why a building stands, experience the art of architecture, and develop English vocabulary: both the specific terms of architecture and scientific experimentation, and more general vocabulary used in classroom discussions. Students will have an opportunity to acquire and practice English in the context of highly involving activities, which will motivate them to use language and help them to acquire appropriate form as they focus on content.

To help children appreciate both the science and the art of architecture, they will be encouraged to look for the links between anonymous, so-called "primitive" architecture and formal architecture. Studying untutored or exotic architecture is valuable for several reasons. First, the study of primitive architecture enables students to understand sophisticated buildings by seeing that they embody the same principles used by animals and vernacular architects. For example, the framework of some modern architecture is modeled on an inverted spider web. Second, vernacular architecture reminds students that buildings should serve human needs and human sensibilities. Finally, vernacular architecture evokes the instincts of the child-builder. By investigating architecture free from the need to be experts, children can enjoy the art.

The unit is highly suited to use in a multi-cultural class. Building is important to child's play across cultures, and thus relates to all children's previous experience. Ability to design and construct is not dependent upon language proficiency, so children who are just learning English may have an opportunity to "shine" in these activities. Also, the various forms of architectural structures can remind children of earlier times and places in their lives. Cambodian students involved in this unit were thrilled to see pictures of houses that reminded them of homes in their native country. The self-esteem of these children was enhanced by their serving as "consultants" on architectural features they had seen in their country of origin.

The unit is also suited to the language needs of second language learners. Daily vocabulary practice using common terms and essential syntax is included in the context of exciting construction activities. Students are placed in situations that require language use: while collaborating on a construction, students practice using spatial prepositions because they are needed; in discussing buildings, they acquire useful, everyday terms for windows, doors, roofs, kitchens, bedrooms, and furnishings.



ADVENTURES IN ARCHITECTURE
OBJECTIVES

Activities **Objectives** Unit 5 / Grades 4 - 6

1	2	3	4	5	6	7	8	9	10	**MATHEMATICS**
	●									Identifies different names for numbers: whole numbers up to one million. (GBC 4,5,6).*
	●									Determines ordinal numbers to 12th. (GBC 4,5,6).
●		●				●	●	●	●	Recognizes different names for whole numbers and fractions (GBC 4,5,6).
	●							●	●	Identifies sets of points and their relations and properties (GBC 4,5,6).
					●		●		●	Selects and applies customary or metric units to measure length, area, volume, weight, time and temperature (GBC 4,5,6).
						●	●	●	●	Estimates results (GBC 4,5,6).
						●	●	●	●	Determines probability (GBC 6).
		●				●	●	●		Organizes data (GBC 4,5,6).
			●					●	●	Identifies geometric relations (GBC 4,5,6).
					●		●	●	●	Applies appropriate units of measurement for length, area, volume, capacity, with length, area, volume, capacity, weight, time, temperature (GBC 4,5,6).
								●	●	Uses units of measurement for length, area, volume, capacity, weight, time, temperature (customary and metric) (GBC 4,5,6).
		●					●	●		Organizes data in charts, tables, graphs (GBC 4,5,6).
		●				●	●	●		Interprets data in charts, tables, graphs (GBC 4,5,6).
						●	●	●	●	Determines probability of event -- like, not likely, least likely, most likely (GBC 4,5,6).
			●			●		●	●	Determines shapes that are alike in size and shape (GBC 4,5,6).

1	2	3	4	5	6	7	8	9	10	**SCIENCE**
				●		●	●	●	●	Identifies and uses simple machines (GBC 4,5,6).
●	●	●	●	●	●	●	●	●	●	Compares objects by special characteristics (GBC 4,5,6).
			●		●	●	●	●	●	Qualitatively describes mechanical advantage (GBC 6).
				●	●	●	●	●		Predicts changes in direction of forces using simple machines. (GBC 6).
●	●									Describes correspondence of animal habitats and animals.
●	●	●	●							Identifies and analyzes structures of animal habitats.

ADVENTURES IN ARCHITECTURE
OBJECTIVES

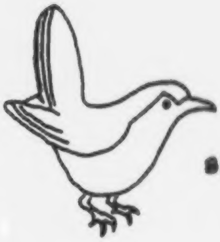
Activities **Objectives** Unit 5 / Grades 4 - 6

1	2	3	4	5	6	7	8	9	10	**SCIENCE** (continued)
●	●	●	●						●	Evaluates the relationships between geography and human survival.
				●	●	●	●	●	●	Constructs and experiments with three-dimensional structures.
				●	●	●	●	●	●	Applies architectural principles and laws of physics to create structures.
				●	●	●	●	●	●	Predicts outcomes of experiments.

1	2	3	4	5	6	7	8	9	10	**LANGUAGE**
●	●	●	●	●	●	●	●	●	●	Determines meaning of unknown words when heard in context (GBC 4).
●	●	●	●	●	●	●	●	●	●	Uses conventional language patterns (GBC 4,5,6).
●	●	●	●							Matches similar sounds represented by letters (GBC 4,5,6).
●	●		●			●				Interprets semantic and syntactic relationships (GBC 4,5,6).
●	●				●		●	●		Interprets instructions (GBC 4,5,6).
●	●					●	●	●		Makes generalizations and draws conclusions (GBC 4,5,6).
						●	●	●		Makes predictions and comparisons (GBC 4,5,6).
●		●					●	●		Recognizes relevance of data (GBC 4,5,6).
	●									Uses creative arts to interpret literature (GBC 4,5,6).
	●				●		●	●		Summarizes information from a variety of sources (GBC 4,5,6).
	●									Participates in the writing process: prewriting, writing, editing, and publishing (GBC 4,5,6).
●										Uses synonyms.
●			●	●						Uses prepositions to show spatial relationships.
	●				●					Identifies parts of a house.
	●				●		●	●		Uses description.
●	●	●	●	●	●					Selects appropriate word usage. (GBC 4).
			●	●	●	●	●	●	●	Uses architectural vocabulary.
●	●	●	●	●	●	●	●	●	●	Follows directions.

*Georgia Basic Curriculum objective for cited grade levels(s).

ANIMALS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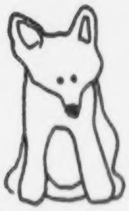
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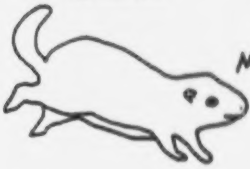
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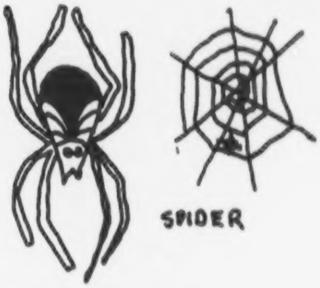
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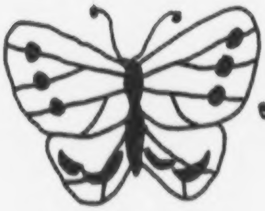
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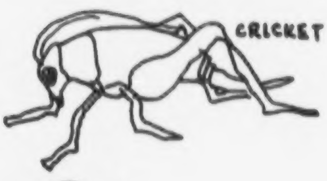
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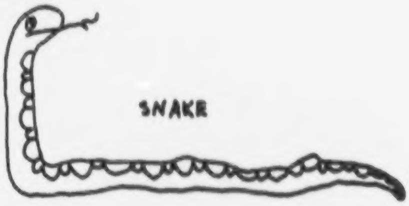
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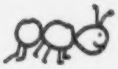
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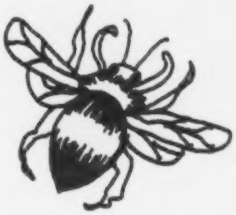
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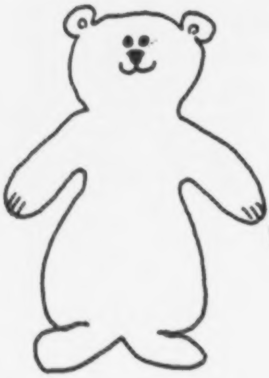
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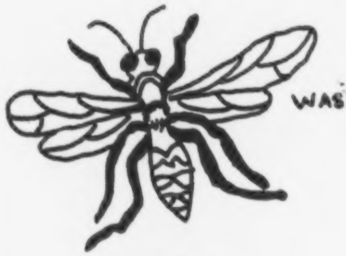
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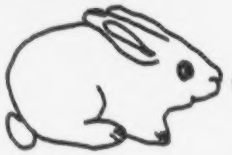
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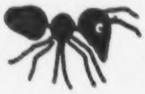
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1. ANIMAL HOMES

Stimulate curiosity about building by bringing in some animal homes: bird nests, beehives, cocoons. Ask the children to bring in some as well. They will be great conversation stimulators and vocabulary expanders.

Procedures:

Large group, teacher directed
Pairs, teacher available

1. Bring in a wasp hive, bird nest, honeycomb from a bottle of honey, or any other animal home you can obtain. Ask if anyone knows what you have. Say, "This is a house made by a ____________," if no one does. Show homes or pictures of homes and repeat the question. Write responses on the board.

2. Say, "This house is called a ____________." Next to it write the name of the animal that builds the house and say, "The animal that built this house is a __________." Have students repeat this chant each time they tell you another animal name or animal home. Give students examples to help them get started, and refer to the animal pictures (see illustration below) and reference books. Sketch the animals (or have a student make a sketch) next to the names on the board. A sample three column list of some animals: the name of their homes, and the shapes of the home is included on this page. See how many animals, homes and shapes you and your students can add.

ANIMAL	HOME	SHAPE
bird	nest	dome
termite	tunnel	semi-circle
fox	den	circle, cylinder
bee	hive	hexagon
mole	tunnel	circle, cylinder
bear	den	dome
spider	web	octagon
wasp	nest	hexagon
butterfly	cocoon	cylinder
rabbit	burrow	cylinder, dome
cricket	nest	dome
snake	burrow	circle, cylinder
ant	tunnel	circle, cylinder

3. Have students work in pairs to find pictures of these animals and their homes, cut them out, and decorate boxes on four sides, but not the top and bottom, so they can become stacked columns to decorate the classroom.

4. Circulate among the students and ask, "What animal is this?" and "What animal built this house?" Encourage students to reply: "This animal is a ______." "A _________ built this house." While students are working, circulate among them and ask the shape of each animal's house.

5. This project probably can't be finished during one class period. Students' materials may be stored inside their boxes; label the outside with their names. They can finish in free time. Encourage students to describe their boxes to peers.

Evaluation:

Listen to students' descriptions of their boxes. Note their use of terms for animal homes and use of the sentence patterns taught in the lesson.

Extensions:

1. Have the students use some of their pictures to decorate folders, which can become notebooks for storing and displaying unit materials.

2. Read *The Supreme, Superb, Exalted and Delightful, One and Only Magic Building* by William Kotzwinkle.

Materials: Magazines -- *Ranger Rick, National Geographic, National Wildlife, Audubon.*
Books from school or local library with pictures of these animals and their homes.
Scissors.
Cardboard cartons about the same size, one for every two students.
Glue, paste or rubber cement.
Wasp hive, bird nest, honeycomb.
Drawing paper.
Pencils.
Rulers.

2. A JUST-IMAGINE HOUSE

Most cultures have at least one myth about a human being swallowed by an animal. This lesson turns the myth into a personal fantasy: Each child will imagine living inside an animal! Encourage children to elaborate on the ordinary features of a house to make the one they imagine and design unique.

Procedures:

Large group, teacher directed
Individual with family members

1. Begin by telling the story of Jonah and the Whale or another "animal swallowing" story. Act out the animal swimming, show Jonah in the boat (candy in toy boat), and the animal opening its mouth and swallowing Jonah (candy). Stop the story when the human gets swallowed and ask, "What kind of home would Jonah find inside the whale?"

2. Elicit responses from the students: dark, wet, rocking, slimy, etc. When you have elicited many ideas from students, bring out the stuffed animals and bean and pretend that this person is going to build a house in the shape of this animal, but design it him/herself.

3. Draw the shape of the stuffed animal on the board or have it already drawn on a piece of paper. Ask what things students want inside - kitchen, bedroom, etc., and write those on the outside of the animal shape. Be sure to find out the dimensions of the home, for example the distance from the paws to the belly of a dog. Will they build a garage between the paws? Do they want to include a playroom? Will there be a large deck on the wings of a "fly house"? Might there be elevators or special spiral stairways around the legs? Spend a lot of time encouraging students to imagine and elaborate. Send them home to think about what real or imaginary animal they will use.

4. For Homefun have the children draw and design the inside of their animal building. Give each student his/her own "bean person," a piece of paper, and a pencil. Have students draw the outline of their animal as large as the paper so they will have plenty of room to design the interior. Have them draw their plans inside the animal.

5. When the students bring their drawings back to school, help them to label the parts of their homes that they have drawn. As you circulate around the room, encourage them to use one another as resources, too.

6. Have students work in small groups of 3 or 4 to ask each other questions such as these:

What is your animal?
Where is the door?
Where are the windows?
Where is the kitchen?
Where is the bedroom?

Materials: A bean with a face drawn on it or other small "person" for each student (i.e., playschool people, tiny doll, pipe cleaner creature, plastic cowboy).
A jelly bean or hard candy.
One-half walnut shell or plastic boat.
Stuffed animal or animal puppet.
Drawing paper.
Crayons/watercolors/chalk/markers/pastels.
Notebook paper.
Pencils.

7. Have students write descriptions of their designs, using all the labeling terms. As a finishing touch, have them draw and color pictures of their home from the outside. This will become the cover of their finished writing project.

8. Encourage students to be divergent thinkers during this activity. Once children are motivated to open themselves to their own creativity, it's difficult to keep them from learning. Be sure there are times when several students sit together so they can share ideas.

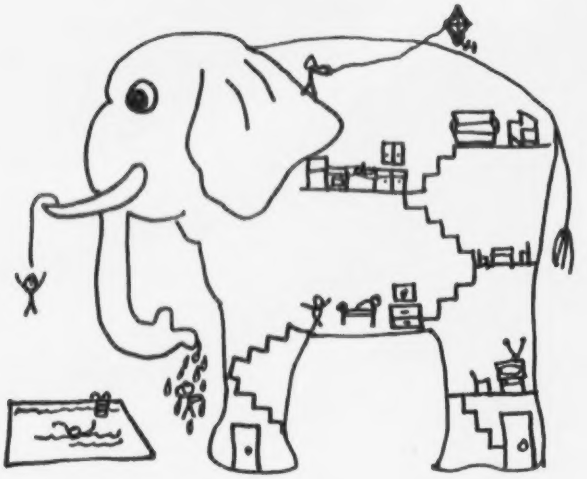
Evaluation:

Interview students about their imaginary houses to assess knowledge of vocabulary and understanding of question and answer structures. Observe student's ability to think divergently.

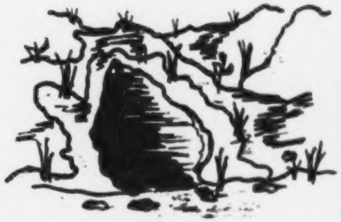
Extension:

1. Make a mural of an animal town, including all the animal homes students have made.

2. Have the students take drawings home to explain to family members. Encourage students to add the new features this telling might inspire.



FIRST HOUSES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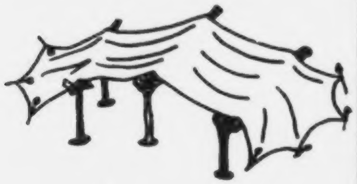
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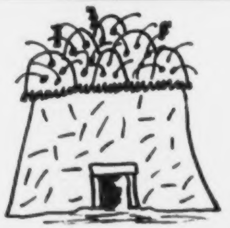
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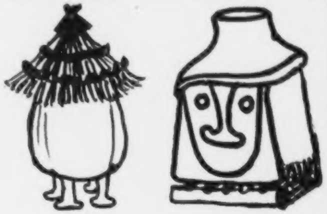
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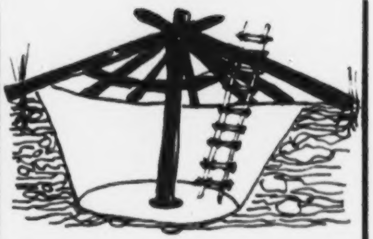
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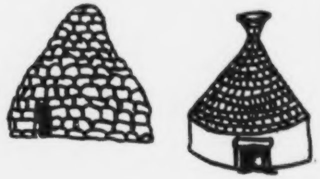
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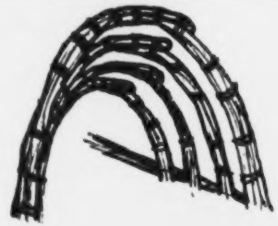
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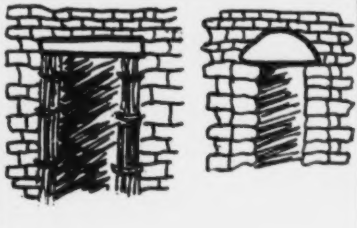
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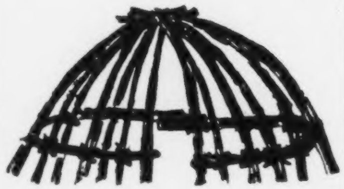
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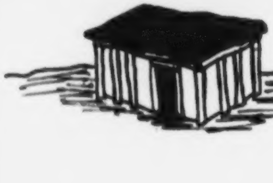
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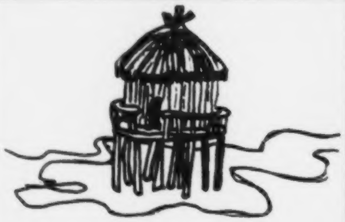
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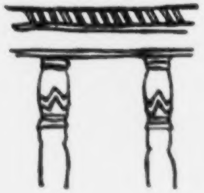
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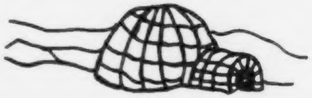
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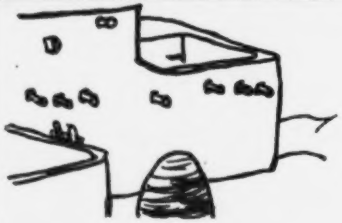
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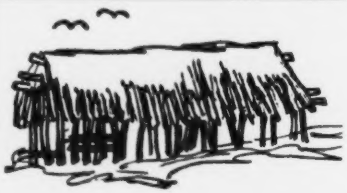
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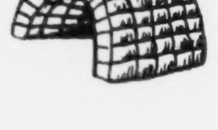
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3. FIRST HOUSES

The first human shelters resembled animal homes. They were made to protect humans from the elements and predatory animals. In these homes food was stored, weapons were built, fires were kept burning, stories were told, and children were raised safely. Anonymous architects adapted their techniques to the geographic location and climatic conditions. Their techniques for insulation (heat absorption and reflection), weather protection (wind breaking, rain shedding), construction, and ventilation have been consistently "borrowed" by formal architects ever since. This activity will teach the basic elements necessary for survival and comfort in different climates.

Procedures:

Large group, teacher directed
Individual, teacher available

1. Included here are teacher notes for you to study to help with explanations of the first houses. For more information, see *Architecture Without Architects* and other references mentioned in the glossary.

a. Caves: These were the first human homes (found in caves of Altamira, Spain and of Lascaux, France). Some caves showing human habitation have been found with earth piled into mounds and possibly used as a base for a bed. Niches were hollowed out of walls to store food. Inhabitants painted animals and humans hunters on the walls, and used stones at the mouth of the cave as doors.

b. Pit dwellings: The forerunners of teepees, these have been found in southern Russia near the river Don. They were an oval about 12' long, dug 3' into the ground. They had vertical supports for a conical skin roof, probably mammoth hides, since many mammoth bones were found near pit dwellings. Others which have been found have fireplaces, storage bins, and chimneys of mud-daubed birch bark.

c. Tents: Tents were used by people living on prairie, tundra, and steppes. Migrant hunters and sheep herders built them. They have wooden frameworks. They can be assembled and torn down in half an hour and packed on an animal. They are covered with reeds, brush, leaves.

d. Beehive Huts: The first mud-daubed houses were built in the Near East. A tight network of poles and branches formed the walls. This technique is called "wattling." The outside is coated with mud. Peasant beehive houses have been found in Apulia on the southeast coast of Italy. Many people have inhabited these dwellings, yet they survived, almost without change, from 2000 B.C.

e. Pigeon Towers (found in the Nile Valley): Birds' droppings were collected in special towers that work on the same principle as a piggy bank. When filled, they were smashed and their precious contents put to use as fertilizers.

f. Arches (found in New Guinea): Arches formed the framework of the men's clubhouse. They were made of bundled bamboo which was covered with thatch or woven mats.

g. Silos: Miniature silos were found on the Volta River. They had thatched roofs, and were decorated to look like a human face.

h. Post and Beam: Some of the earliest builders used post and beam construction. Before the arch, they used two vertical bundles (posts) to support a horizontal beam (lintel). The Egyptians used bundled papyrus plants for posts. The later "aesthetic" bulge which architects placed the middle of columns began as compressed, wrapped papyrus bulging under the weight of the beam.

Materials:
Transparency of first houses.
Overhead projector.
Duplicated copies of first houses for students.
World map or globe.
Pencils.

i. Domes (found in the Amazon): Domes resemble bowls turned upside down. Domes have no middle supports to hold them up. The tension from the bent poles keeps the framework up.

j. Igloo: This structure was another dome used on the tundra by eskimos who were seminomadic hunters. Igloos were built in groups of three or four. The design hasn't changed in 10,000 years, and can be built in an hour at most. Igloos retain heat, though they are built of a material that depends on extreme cold to maintain its shape.

k. Sod House: This home is found in temperate areas of of the globe where the summer is hot and long and the winter is severe and windy. Prairie dwellings using post and beam were covered with sod. The name comes from the sod roof.

l. Adobe: Adobe is found in desert regions all over the world. It shields the interior from intense daytime heat and stores heat for cool nights. Heavy clay is moistened and pounded into a plastic mass with added straw. Bricks are formed by hand or made by pouring mud into rectangular molds made of wood or stone. The bricks are baked in sun for two weeks. Adobe homes usually have flat roofs because there's little need for shedding rain in desert regions.

m. Rain Forest Homes: The rain forests are the most difficult areas of the world to inhabit. Weather is hot, rainy, and steamy all year, with no relief at night. Roofs are sharply pitched to shed rain. Structures have lots of ventilation. Homes have loosely woven walls which can be rolled up during the day, and raised legs to keep out water and predatory animals, and to catch breezes.

n. Communal Hut (found in South America): Huts have sharply pitched roofs and no walls to maximize ventilation. Homes are made entirely of vegetation: saplings or bamboo make framework and support leaves, grass and thatching. Jungle architects are weavers and rope-makers.

o. Colonnade (Egypt, 3000 BC): The basic design has not changed since 3000 B.C. It allowed architects to support a roof and upper floors with a solid structure.

p. Vault (found in Theraen, in South Greece): The house is a vaulted cell. First vaults show the transition from cliff-face dwellings to half-dug and eventually free-standing houses.

2. As you explain these first houses, you can be very brief or lengthy, depending on your students' level of English proficiency. Use transparency of the first houses blackline and an overhead projector.

3. Show students where the various houses would be built, using the world map or globe. Encourage students to note if any of these early homes are found, or have been found, near their countries of origin.

4. Ask, "Where would people live in caves?" "Would it be hot or cold there?" (answer: it would be hot and cold). Why? "Where would people live inside the ground?" "Would it be hot or cold there?" (answer: it would be hot). Why? Model response patterns for students and encourage everyone to contribute ideas. Continue this procedure about the other dwellings.

5. Help students to label their own pictures of primitive houses with the names of the dwellings. Watch for restlessness; you will probably have to do a lot of gesturing and abbreviation of the information. You may choose to use two sessions to introduce all the material. Expect to have to use reference materials to answer students' questions. Look for connections between first houses and animal homes, and between first houses and houses we live in today. Be sure to take advantage of students' expertise about the local architecture of their homelands.

6. The primitive houses can become the first pages in students' architecture notebooks, which can be maintained throughout the unit.

Evaluation:

Check students labels for accuracy and help students who are having trouble. Observe students' use of reference materials to assess need for more instruction.

Extensions:

1. For Homefun, have students make a model of a primitive home from natural materials such as grass, sticks, rocks and mud.

2. Give the students a vocabulary word search with architectural terms hidden, and teach them strategies for finding words. (e.g., Look for the first letter of words, and when you find it, look in all directions for the second letter.) Ask students to describe other strategies they use.

4. POST AND BEAM

Posts and beams form doorways and are the basic element of modern Western architecture. So that students can internalize the basic idea of Post and Beam, they must practice building them. This activity is the first of two which teach post and beam construction.

Procedures:

Small group, teacher available

1. Review what students remember about first homes, and tell them they are going to be architects or planners and builders for this activity.

2. Place students in groups of 3 or 4. Try to include children at a variety of proficiency levels in each group.

3. Give each student a Post and Beam sheet to add to their notebooks. Explain directions.

4. As students experiment with adding details to the post and beams, encourage talk and sharing of ideas.

Evaluation:

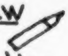
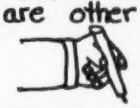
As you walk with students to lunch or other activities, ask them to point out evidence of post and beam construction in the school building.

Extension:

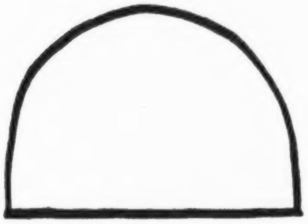
For Homefun, have students sketch buildings with three different roof designs. Discuss the sketches that students bring in and display them on the wall.

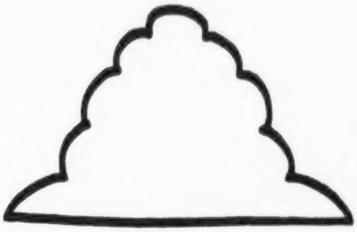
Materials: Post and Beam sheet (copied from black line master).
Scissors.
Markers, crayons and/or colored pencils.
Post and Beam transparency (also copied from master) .

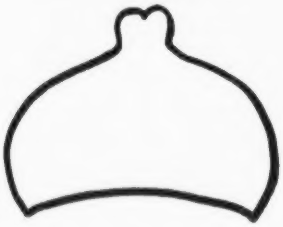
POST AND BEAM

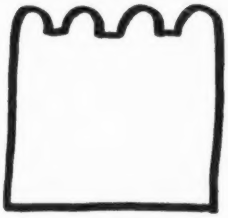
Most buildings use post and beam construction. One way they are made different from each other is by using different details. One detail is the roof. What are other details you usually find on a building? Draw  and Write  labels of the details you might see on a building.

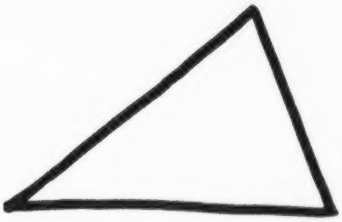
Now cut out theses roofs and try them on all your buildings and this one too.→ How do they change the way your buildings look? Which combination do you like best?

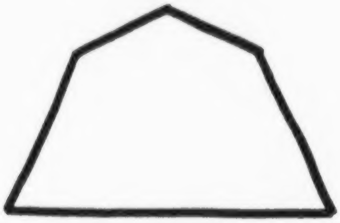












5. CARD HOUSES

Nothing helps children understand a concept better than play. When play and work can be done together, lasting learning can happen. Practice with post and beam is one way to help students understand what's so amazing about this building technique. Build one too!

Procedures:

Small group, teacher available

1. Ask students to bring a deck of playing cards from home.

2. Allow students to work on card houses in pairs. Ask them to experiment, trying to build the tallest card house.

3. As you circulate around the room, talk with students about which cards are posts and which cards are beams in their structures.

4. As students build (and rebuild!) take pictures of interesting structures. Everyone will enjoy seeing the results, and the pictures will make a great school bulletin board to "show off" your project!

Evaluation:

This activity is self-evaluating: either the card houses stand, or they fall, usually the latter!

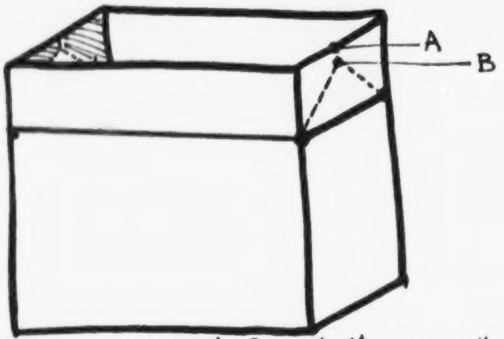
Extension:

Explain the idiom "house of cards." Assign students to use the idiom appropriately three times in the next week. Try to find occasions to use it yourself!

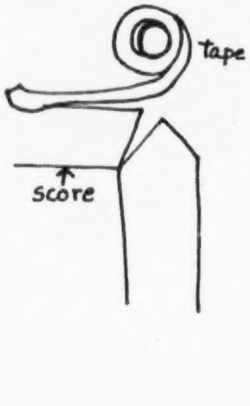
Materials: Playing cards.
Polaroid or other camera and film (desirable, but optional).

BOX HOUSE DIRECTIONS

1. Cut flaps off box.
2. On the short side of the box measure and find the middle. Call it point A.
3. How many inches is it from A to the corner? ____ Add 2 inches= ____.



4. Use the number you just found. Measure that many inches down from each corner. Mark a point there.
5. Connect your points all around.
6. Open your scissors and use the point to cut a little into the box right on the lines you made on the long sides. We call this "scoring."
7. Mark a point 2 inches down from A. Call it B
8. Draw diagonal lines from B to the points you made back in #4.
9. Have your teacher follow your lines and cut out the extra card board.
10. Bend in side flaps for roof, and tape.
11. Decorate with paper, crayons, tin foil, ribbon, yarn, fake flowers or other fun things.



6. BOX HOUSES

Doll houses, which have been popular for centuries, reflect the culture of the children who play with them. With a cardboard box, each student in your class can build a doll house as he/she develops "household" vocabulary, practices following directions, and learns about how buildings are constructed.

Procedures:

Large group, teacher directed
Pairs, teacher available

1. Show the students the model doll house or pictures. Discuss what the house is, what it is for, and what children might like to do with it.

2. Give the instruction sheets to students. Demonstrate what the students will do on their own, and what you will help them with on the boxes. (You might choose to do some of the more difficult cutting, depending on the age and dexterity of your students).

3. Ask students to review the directions by repeating them in their own words, to make sure that they understand.

4. Divide the students into pairs, providing more proficient models for less proficient students. Pass out materials, and circulate as a facilitator and trouble shooter as students build their houses.

Evaluation:

As you talk with the children, elicit the target "household" vocabulary for the lesson, and check for understanding of the instructions.

Extensions:

1. One side of the house may be cut out and attached as a second floor.

2. Have students paint and decorate the houses. You may wish to have this completed over several days, or at home.

Materials: Cardboard box for each student.
Exacto knife (for the teacher).
Scissors.
Masking or duct tape.
Instruction sheets.
Ruler.
Pencil.
Pocket knife.
Model doll house, or pictures of doll houses.
Paints, wallpaper samples, fabric scraps (optional).

7. HOLD THE BRICK

This building activity encourages experimentation and extends building principles one step further. Computer cards will be altered and combined in order to support the weight (or stress) of a brick.

Procedures:

Large group, teacher directed
Small group, teacher available

1. Have students sit in a circle. As you and the students pass a brick around the circle, ask students to concentrate on the weight of the brick, and to try to remember how much it weighs.

2. Carry out an "embedded pattern practice" as students pass the brick. As each student passes it to the next person, the student says the next person's name and then tells the person, "__(Name)__, this is a heavy brick."

3. After the brick is handed around the circle, set up a second "embedded pattern practice" on comparatives, asking, "What in the room is heavier than the brick?" After a student answers with the name of some object, ask another student to confirm the choice, "Is the ____________ heavier than the brick?" The responses will be, "Yes (or no) the ___________ is (is not) heavier than the brick."

4. If students have trouble getting started with comparatives, model the response for them. Pick up a pencil and ask, "Is the pencil heavier than the brick? No, the pencil is not heavier than the brick." For students who are ready, have them compare several items, and use the superlative. Which is the nearest brick?

5. Tell the students that they will again become building designers and builders for this activity. Have them separate into small groups of balanced language ability. Try to provide a fairly proficient English model for each group.

6. Each group receives 17 computer cards, 1 foot of tape, and an unlimited number of staples. The aim of the activity is to build a structure no higher than 18", using the fewest cards which will support the brick. Have fun!

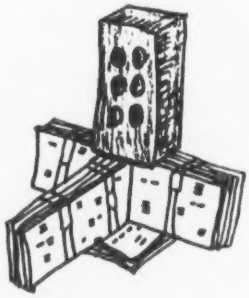
7. Before testing the designs against the weight of the brick, discuss the designs and have students predict which ones will be successful. Make a chart to record predictions and results. Give an award (the brick?) for the strongest structure!

Evaluation:

Listen to student responses during the pattern practices to determine which students need more work on descriptive or comparative forms.

Extension:

Have students build structures using rolled newspapers for post and beam framework. How much weight will various structures support? Test by adding weight until the structure collapses.



Materials: Computer cards or oaktag cut into 4" x 7" sections.
1 or more Bricks.
Stapler for each small group (or as many as you can locate).
Tape.
Rulers.
Camera (if possible).

8. ARCHES

The invention of the arch in 300 BC was a marvel not to be equalled until the 20th century invention of the cantilever (see glossary). Let's investigate this marvel by comparing it to other structures. These constructions are used as floors and ceilings.

Procedures:

Large group, teacher directed
Individual, teacher available

1. Before class begins, make at least one of each of these models. Use paper towel rolls for columns. Be sure the structures are only resting on the towel rolls and are not attached in any other way. If these structures were made of metal or plastic, heat would be used to join the parts. Melting or welding would be an inherent part of the structure and not an additional strengthening agent. The tape and glue become a deceptive part of these paper structures and add strength that is not inherent in the structural form, so when you must use tape or glue in construction, use it sparingly.

2. Explain the construction of the forms before you begin the experiment. Have students pass out data sheets, as you set up the five models. Explain the data sheets.

3. Have students place paper on top of each structure, one sheet at a time, keeping track of how many sheets are used. Have two students serve as "official paper counters" for each structure. Tell the students to examine the structures very carefully to detect when each one begins to buckle under the weight of the paper.

4. Begin with model 1 and add sheets of paper on top of the structure until the structure begins to bend under the weight of the paper. The number of pieces of paper held on top of the structure determines the times its own weight it could be supported (i.e., 4 pieces of paper held means 4 times the structure's own weight could be supported). Stop after the first model and ask for predictions about the remaining structures.

5. Help students plot the information they obtain on a graph and then later color in bars to make a bar graph.

Evaluation:

Assess students' performance on the data sheets, and observe responses in discussion.

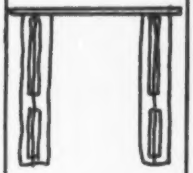
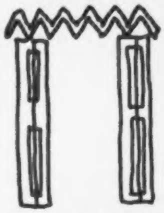
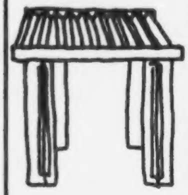
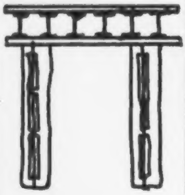
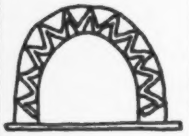
Extensions:

1. Place blocks in an arch on top of a board lying on the floor. Place another board on top of the first one and the blocks, and stand the arch and boards up. Remove the boards, and the blocks should remain standing in an arch. Discuss with students how this demonstrates how tension contributes to the strength of a structure.

2. If you have a very bright group of students, you may have them determine the static and flexible joints contained in each structure, as the form buckles under the weight.

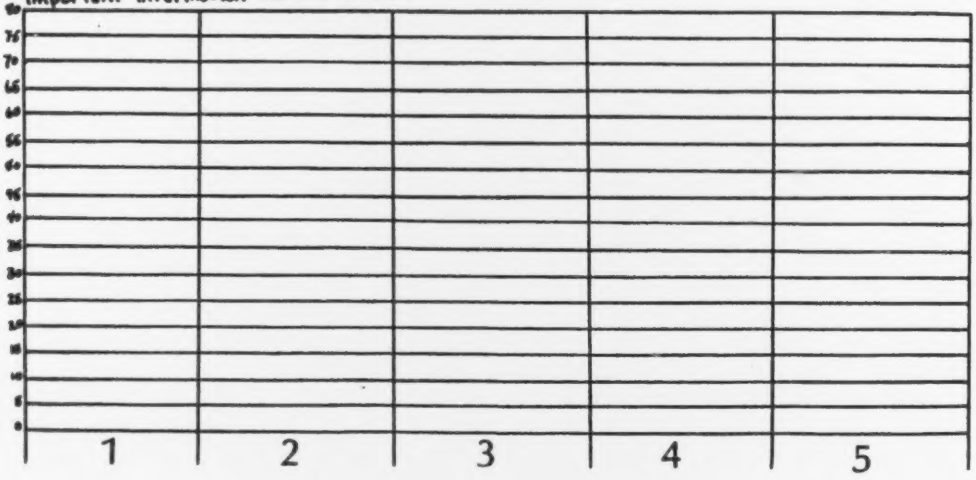
Materials: 1 Ream of ditto paper (used as a weight).
Scotch tape.
Glue.
Paper towel rolls.
Data collecting sheets for students.

ARCHES

1	2	3	4	5
PLATFORM	**ACCORDION PLEATED**	**FOLDED PLATE**	**I-BEAM**	**ARCH**
				
1 piece of paper 2 paper towel rolls	1 piece of folded paper. 2 paper towel rolls	2 pieces of paper - 1 accordion folded - 1 cut into thin strips, lightly glued to accordion 4 paper towel rolls	2 pieces of paper - one on top 1 on the bottom 1 piece of paper cut into strips and folded: I then taped onto top & bottom 2 paper towel rolls	3 pieces of paper 1 for top 1 for bottom 1 accordion pleated and sandwiched between the top & bottom pieces of paper. 1 piece of paper for arch to be glued on to. Bend sandwich and glue to page.

(*) PIECES OF ROLLED & TAPED PAPER CAN BE SUBSTITUDED FOR PAPER TOWEL ROLLS.

This experiment compares post and beam construction to arch construction. As you add pieces of paper to each structure, count them carefully, and record the important information on this chart.



9. GEOMETRIC SHAPES

If you or your students tried to make a house with straws, you would find it could not stand by itself without tilting unless the shapes are reinforced. This activity helps determine how flexible shapes can be made stable or static. It is really an investigation of triangular shapes, because they are the most stable shapes. Guide students to the discovery of this concept by working with only one "wall" of a structure in this activity.

Procedures:

Large group, teacher directed
Individual, independent

1. Explain to students they will make geometric shapes today, including squares or quadrilaterals, pentagons, hexagons and octagons.

2. Divide students into groups of three, combining students of different proficiencies and language backgrounds when possible. Have the students construct these shapes using the straws and pins (see diagrams on blackline master).

3. When the groups finish making the first shape, ask them all to take the square, stand it upright, and push on it. They will be able to observe that square structures are wobbly.

4. Ask the students to add another straw to the square shape so it no longer will wobble. They will discover that this piece will need to be added diagonally across the square, making two triangles. Triangles are the most stable form because when force is applied all the sides work to hold it together.

5. Each of the flexible shapes illustrated can be made rigid in the same experimental manner. Triangles are the clue. Encourage students to use as few straws as possible. Have them count the number of straws used.

6. Save all the completed shapes. Make a chart showing how many sides a figure has and how many straws are needed to stabilize that figure. (4-sided = 1 straw; 5-sided = 2 straws; 6-sided = 3 straws; 8-sided = 5 straws) Ask students to look for a pattern, and to try to come up with a rule to determine the least number of straws to stabilize a figure. (The number of sides minus 3).

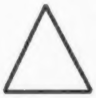
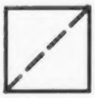
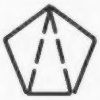
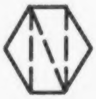
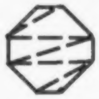
8. Have students record results and conclusions of the experiment, and add this material to their architecture folders.

Evaluation:

Check notebooks to see if students have accurately understood and reported on the experiment.

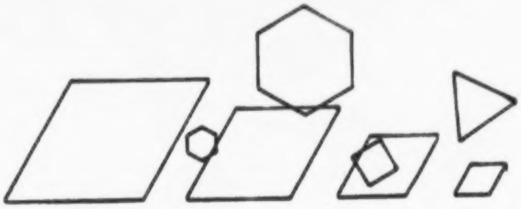
Extensions:

For Homefun, have each student take a shape home, and explain the activity to a family member.

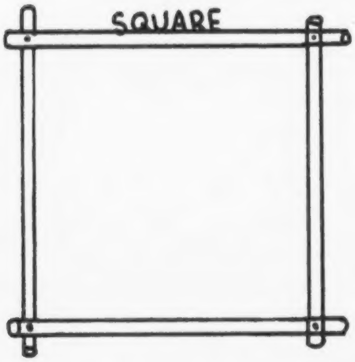
Shape					
Sides	3	4	5	6	8
Straws Added	0	1	2	3	5

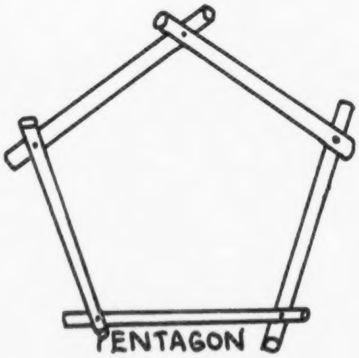
Materials:
Straw sections.
Straight pins.
Paper and pencils, or chart paper and markers for recording data.
Blackline master illustrating the geometric shapes activity.

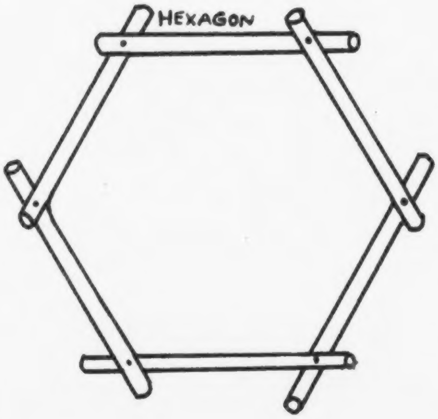
GEOMETRIC SHAPES

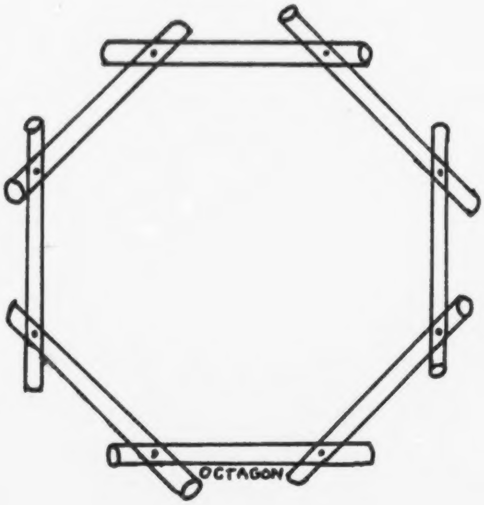


1. Make these shapes using straws and straight pins.
2. Stand them up on the table or desk and give a gentle push.
3. As they are made here, these shapes are flexible. This experiment is designed to investigate ways to make these shapes static.
4. By adding straws in certain places, these shapes become stronger. Try out different arrangements until you find ways to make each shape stronger. The aim is to use as few straws as you can. HAVE FUN! Draw in your straw solutions as you find them on these shapes.









10. DOMES

The culminating set of activities for this unit involves the construction of a dome by each student. The dome is an early anonymous building form which has been modified and popularized by architect and designer Buckminster Fuller. A geodesic (earth altering) dome is made of light, straight structural elements mostly in a state of tension. It is comprised of a series of triangular forms joined to make the framework. The tension formed by connecting these elements, as students saw earlier, actually strengthens the entire structure.

Procedures:

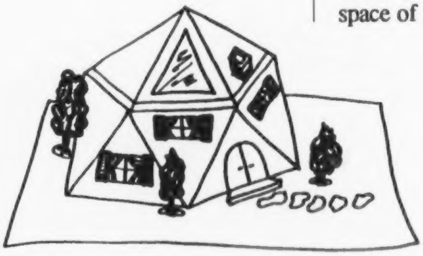
Large group, teacher directed
Individual, teacher avaiable

1. Review shapes vocabulary with cut out shapes and straws, using a "Total Physical Response" activity. Give commands incorporating terms that students need to know, e.g., "Put the triangle on top of the square;" "Count the support straws in the eight-sided figure, and give that number to Tony."

2. The paper clips or pipe cleaner pieces can be used for structural support. (See illustration on page 5-24.)

3. After the students have assembled their domes, they are to be decorated. Each triangular face of the dome can be covered with stiff white or colored paper which has been cut to fit and decorated. Encourage students to plan their decorations to give an overall effect when completed. A student might choose to coat the entire outer surface in glue and then roll it in sand. One panel might be covered with glitter to represent a solar collector. Colored decorations might be placed on the inside. Remember, dome houses have doors and windows, too!

4. Ask the students where the door is and where the windows are. Have them explain their decisions for placement of these features and for decorations.



Evaluation:

Note students' comprehension of terms and directions during the introductory activity. and as they explain their domes.

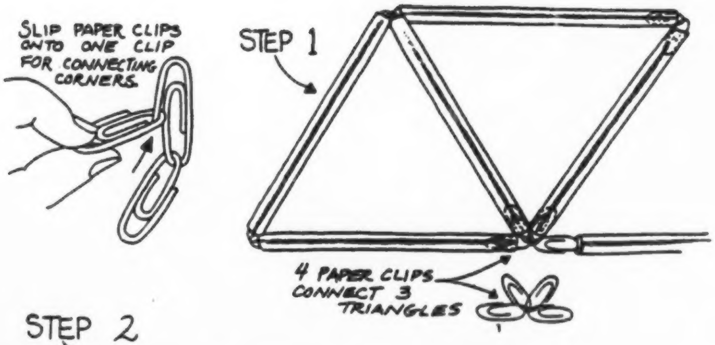
Extensions:

1. Have students design and build a future city using the dome homes.

2. Have the students make drawings to decorate the interior space of the domes.

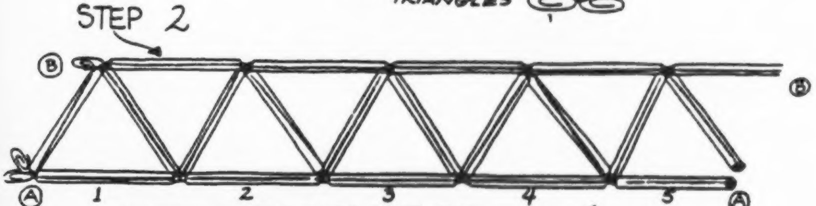
Materials: Straws.
Pipe cleaners.
Paper clips.
Stiff white paper.
Scissors.
Rulers.
Construction paper.
Glitter.
Sand.
Markers.
Cellophane.

DOME CONSTRUCTION

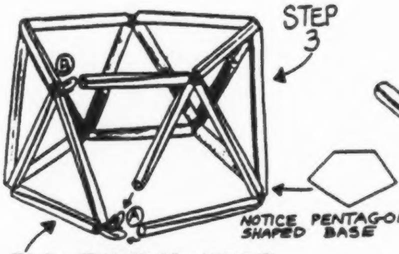


SLIP PAPER CLIPS ONTO ONE CLIP FOR CONNECTING CORNERS.

4 PAPER CLIPS CONNECT 3 TRIANGLES

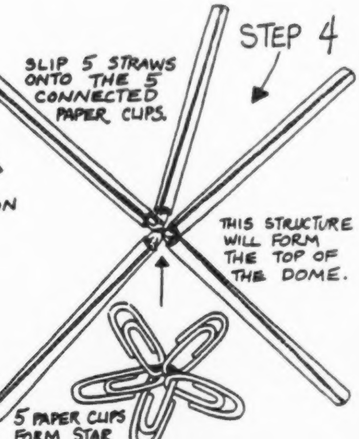


CONNECT 5 TRIANGLES THAT FORM THE 5 SIDES.
SLIDE PAPER CLIP Ⓑ INTO STRAW Ⓑ
AND PAPER CLIPS Ⓐ INTO STRAWS Ⓐ.



NOTICE PENTAGON SHAPED BASE

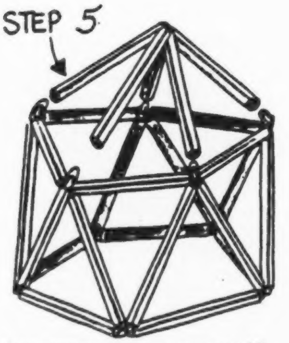
FOLD TRIANGLES AROUND SO THAT THEY FORM A 5-SIDED STRUCTURE.



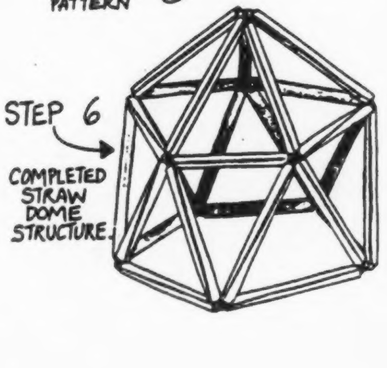
SLIP 5 STRAWS ONTO THE 5 CONNECTED PAPER CLIPS.

THIS STRUCTURE WILL FORM THE TOP OF THE DOME.

5 PAPER CLIPS FORM STAR PATTERN



CONNECT TOP OF DOME.



COMPLETED STRAW DOME STRUCTURE.

GLOSSARY

A-frame: structural framework with steeply sloped sides in an A-shape

arch: curved structure that supports weight of material over it

architect: person who designs and constructs buildings and bridges

architecture: art and science of design and construction of buildings and bridges

beam: long, thick piece of wood, metal, or stone used as a horizontal support for roof and ceiling (see "lintel")

brace: a device for setting up or maintaining tension; a diagonal prop used as a support to resist strain

Buckminster Fuller: architect and inventor of the geodesic dome; born 1895

cantilever: a large bracket projecting from a wall to support a higher floor

circle: a plane figure

classical: being a model of its kind; follows certain traditional standards of Greek and Roman style

column: a pillar; a vertical, cylindrical shaft

cube: a solid with six equal square sides

cylinder: a solid or hollow rectangular form curved, rolled and rotated around a central axis; the ends are parallel and equal circles

daub: clay mud used as plaster and sometimes then whitewashed with white clay and water

dome: hemispherical roof or structure

dynamic: kinetic; able to shift in relation to other materials (see "static" and "compression")

eave: lower edge of a roof, usually projecting beyond the side of a building

expansion: increase in area or volume; extended (see "contraction")

flexible: able to bend without breaking; not rigid

foundation: supporting base, partially underground, on which something rests

frame: basic constructed structural support around which something is built

heptagon: a plane figure with seven angles and seven sides

hexagon: a plane figure with seven sides and seven angles

horizontal: flat, even, level, parallel to the plane of the horizon; the line where the sky meets the earth

I-beam: steel beam shaped like an I in cross-section

lean-to: a simple structure that has a single slant roof

lintel: horizontal crosspiece over a door; carries weight above it (see "beam")

octagon: a plane figure with seven angles and seven sides

ordinal: numbers expressing a specific succession: first, second, etc.

pentagon: a plane figure with five sides and five angles

post: piece of wood, metal, etc., usually long and square or cylindrical, set upright to support a building

pyramid: structure with a square base and four sloping, triangular walls meeting at the top

quadrangle: a plane figure with four sides and four angles

rampart: an embankment of earth

rigid: stiff, firmly fixed, unyielding

shaft: main part of a column between the base and capital

skeleton: hard framework of a body, but also the framework of a building

square: plane figure having four equal sides and four equal angles

static: pressure exerted on a motionless mass; equilibrium; not moving, stationary (see "flexible" and "tension")

structure: something built, composed or arranged such that all the parts work as a whole

tension: stress on a material produced by the pull of force

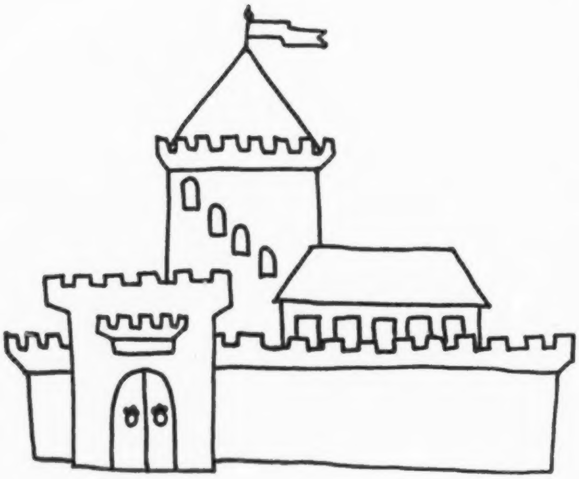
triangle: plane figure with three sides and angles; when pressure is applied, each side works together to hold its place

truss: bracket; a rigid framework supporting a roof

vault: arched roof

vertical: perpendicular to the plane of the horizon; upright

wattle and daub: method of construction with thin branches (wattles) plastered over with clay mud (daub)



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PERSONAL PIZZAS
AND OTHER RECIPES FOR LEARNING

by
Mary Lou McCloskey

Unit 6: Grades 4 - 6

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	4. Publishing a Cookbook: Writing Process	6-12
	5. Pizza Preferences: Graphing Food Groups	6-13
	6. Pizza Toppings Decisions: Flow Charts	6-15
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PERSONAL PIZZAS

Why should you cook in class? Isn't cooking just recreation for the students, a "time off task?" No way! This unit puts enjoyable activities relating to food and cooking (even pizza-making!) at the heart of your instruction. Studying foods has an advantage for ESL teaching: foods are concrete, familiar and interesting to everyone, and thus can be used as an appropriate starting place for language instruction.

Although foods may be familiar to everyone in a multilingual class, the way these foods are prepared in students' homes can make the results very different. Learning about one another's foods can can be an excellent way to develop understanding of cultural differences, and to celebrate these differences. It is our goal that the multi-cultural classroom become a community in which developing an awareness of, and competence in, multiple cultures is indeed the normal human experience.

Cooking is applied to many content areas in this unit. Your students will have the opportunity to acquire and use the language for tools, ingredients, measurements and instructions used in cooking in this country. You and your students will explore health concepts of nutrition and knowledge of the four food groups. You will use graphs and charts to organize information. You will use the information you have organized and mathematical processes to solve problems with immediate consequences (such as whether or not the next meal will be edible, and whether you will have the right amount of food). You will discover and explore flow charting as an introduction to the way in which computers are programmed to address and solve problems.

The unit uses processes which will strengthen relationships within the class, within the school community, and between school and home. Students participate in many of the activities in pairs and in small groups which in they will develop and use cooperation skills. Two of the activities involve input from families through "Homefun," thus strengthening the connections and promoting cooperation between home and school. Several of the activities provide opportunities for the class to reach out to the school community, as students share what they have created. Students will publish an international cookbook which will be available for all to read, and they can invite family, school, and community persons to the publication party. Students will actually prepare food, which can be shared with selected school personnel. Finally, students reach out to the school community to teach others what they have learned. They will create flow charts giving instructions for simple tasks, and put them on the wall for everyone in the school community to see.

PERSONAL PIZZAS
OBJECTIVES

Activities **Objectives** Unit 6 / Grades 2 -5

1	2	3	4	5	6	7	8	9	MATHEMATICS
		●		●					Identifies different names for whole numbers and fractions (GBC 2,3,4,5).*
		●			●				Determines pairs of numbers given a relation or rule (GBC 3,4,5).
						●	●	●	Identifies geometric shapes and relations (GBC 2,3,4,5).
●	●	●	●		●	●	●	●	Selects and uses units of measurement and time (GBC 2,3,4,5).
		●		●	●				Adds, subtracts whole numbers (GBC 2,3,4,5).
		●		●	●				Selects and uses operations (GBC 2,3,4,5).
●	●	●		●	●	●	●	●	Organizes and interprets data into charts, tables, and graphs (GBC 2,3,4,5).
		●			●				Identifies relations of numbers: factors, multiples (GBC 3,4,5).
●	●	●	●		●	●	●	●	Uses measurement terms appropriately.
●	●	●	●		●	●	●	●	Applies customary and metric measurements (GBC 2,3,4,5).

1	2	3	4	5	6	7	8	9	SCIENCE / HEALTH
●	●	●	●	●	●	●	●	●	Identifies food groups and a variety of foods for each (GBC 2).
●	●		●	●	●				Explains the importance of eating from each food daily (GBC 2).
●	●		●	●	●				Identifies nutritious snacks which promote good health (GBC 3).
●	●		●	●	●				Identifies foods that affect growth and development (GBC 3).
●	●	●	●	●	●	●	●	●	Recognizes the need for foods that contain nutritive value (GBC 4).
●				●	●				Evaluates a personal diet (GBC 4).
●				●	●				Plans a balanced meal (GBC 3,4,5).
●	●	●	●	●	●	●	●	●	Collects, writes and reads information in tables, charts, graphs (GBC 4,5).
		●		●	●				Solves word problems (GBC 2,3,4,5).

1	2	3	4	5	6	7	8	9	COMPUTER SKILLS
					●	●	●	●	Follows decision making process used in programming computers.
					●	●	●	●	Relates shape symbol to instruction on a flow chart.

PERSONAL PIZZAS
OBJECTIVES

Activities **Objectives** **Unit 6 / Grades 2 -5**

1	2	3	4	5	6	7	8	9	**COMPUTER SKILLS** (continued)
					●	●	●	●	Follows directions using a flow chart, making decisions at appropriate points.
							●	●	Creates a flow chart using three flow chart symbols with at least one decision point.

1	2	3	4	5	6	7	8	9	**LANGUAGE ARTS**
●	●	●	●	●	●	●	●	●	Retells information presented orally (GBC 3).
●	●	●	●	●	●	●	●	●	Uses listening skills in following directions (GBC 2).
●	●	●	●	●	●	●	●	●	Interprets oral and written instructions (GBC 2,3,4,5).
●	●	●	●	●	●	●	●	●	Uses conventional language patterns (GBC 2,3,4,5).
●	●	●	●	●	●	●	●	●	Uses expressive and adaptive language (GBC 2,3,4,5).
●	●	●	●	●	●	●	●	●	Selects appropriate word usage (GBC 2,3,4,5).
●		●		●	●				Classifies words (GBC 2,3,4,5).
●	●	●		●	●				Makes generalizations, draws conclusions (GBC 2,3,4,5).
				●					Distinguishes between facts and opinions (GBC 2,3,4,5).
		●		●	●	●	●	●	Recognizes the relevance of data (GBC 3,4,5).
●	●	●	●	●	●		●	●	Participates in the writing process: prewriting, writing, editing and publishing (GBC 2,3,4,5).
●		●		●	●				Makes predictions and comparisons (GBC 2,3,4,5).
	●	●	●	●	●		●	●	Applies basic spelling rules and patterns (GBC 3,4,5).
	●		●				●	●	Uses correct punctuation, capitalization, and grammar (GBC 2,3,4,5).
			●	●	●		●	●	Reads orally, conveys meaning (GBC 3,4,5).
●	●	●	●	●	●	●	●	●	Actively participates in oral discussions.
●	●	●	●	●	●	●	●	●	Uses terms for foods and cooking implements.

1	2	3	4	5	6	7	8	9	**OTHERS**
●		●	●	●	●	●	●	●	Works in small groups and pairs to complete tasks.
●	●		●	●	●	●			Identifies characteristic recipes from a variety of countries and cultures.

*Georgia Basic Curriculum Objective for given grade level(s).

1. COOKING TERMS AND TOOLS: ROLE PLAY

In this activity, the teacher introduces the cooking unit by helping students to become familiar with common tools and terms for cooking. Children actively manipulate the tools as they give and follow directions for cooking imaginary dishes.

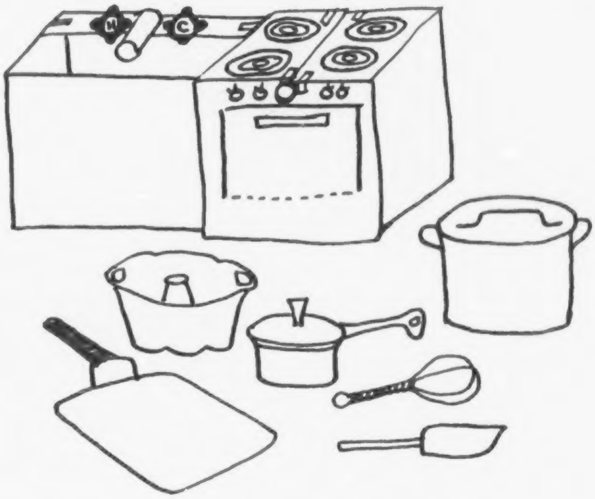
Procedures:

Large group, teacher directed
Pairs working independently

1. Select a relatively proficient student to be the "guinea pig" for the first role play. Give the student instructions for preparing a simple dish (e.g., spaghetti). For more proficient students, leave out some explicit terms and substitute descriptive terms and gestures (e.g., "long thin noodles" for "spaghetti."

2. Use specific measuring terms, and have your student cook measure the amounts using sand or water. Discuss, if necessary, the different types of measurement systems used in different parts of the world: some cultures use grams to measure flour, some use ounces, but in the United States, most people use cups.

3. Encourage class members to guess the name of the dish the student is pretending to cook. For a little more challenge, and to prolong the game, have students who think that they have guessed the dish give the next instruction, and you can determine if they are right or wrong without giving away the answer.



4. Give several other students chances to role play before the class, with the rest of the class guessing what dish is being prepared. Give the direction-giving role to students as soon as they understand the game.

5. Introduce or review the names of the four food groups, and ask students to tell what group or combination of groups is represented by the foods that are being prepared in the role play situations. Ask students to tell from which country the food originated. Point out that many North American foods originated in other countries. Also discuss whether the food being prepared has nutritional value, or is loaded with "empty calories." Explain these concepts, if necessary.

Materials: Cooking utensils: a large variety of pots, pans, and measuring implements. Ask each student to bring an assigned implement - you may need to send home a sketch of the utensil, drawn by you or a student.
A "stove" and "oven": Students will enjoy making a stove out of a carton. Turn the carton on its side and glue paper circles for burners on the top. The carton lid can serve as an oven door.
A "sink": Use another carton, upright, with attached cardboard faucets.
A sand or water table borrowed from a kindergarten class, for measuring.
Chart paper and marker.
Index cards.

6. As students use cooking terms, enter them on a cooking terms chart, leaving room for students to illustrate the terms at a later time. The chart below is an example. Adjust the terms included to the interests and proficiencies of your students. Leave the chart on the wall for reference during the unit.

7. Divide students into pairs and distribute some cooking utensils to each pair. Provide paper circles for students to place on tables or desks to represent burners, if you like. Instruct students to take turns playing the role of cook and the role of instruction-giver.

8. Alternately, have a student pantomime preparing a dish and telling about it while the other tries to guess what dish is being prepared. After a correct guess, partners switch.

Evaluation:

Observe students as they give directions to one another to determine terms and forms which need more practice. Observe their accurate use of measurement terms, as well. Ask individual students to read terms from the chart.

Extensions:

1. Put the stove, sink and cooking utensils in a learning center, with instructions for pairs of students to role play preparing a simple dish, and then to collaborate in writing down the recipe.

2. Place cards with names of utensils and equipment in the center. Have students match the cards with the utensils. As a self-check, children can match the numbers on the back of the cards to those on the utensils.

* * *

COOKING TERMS CHART

FOODS	MEASURING TERMS	UTENSILS
flour	cup	saucepan
eggs	pint	ladle
pasta	teaspoon	baking pan
tomatoes	tablespoon	spatula
soy sauce	quart	rubber scraper
fish sauce	half	wisk
hot sauce	quarter	steamer
rice	third	Dutch oven
onions		burner

RECIPE FORM

Name of Recipe ____________________

English Name ____________________

From the Kitchen of ____________________

Serves __________ From what country ____________________

Ingredients: ____________________

____

____

____

Procedures: ____________________

____

____

____

____

Serving Suggestions: ____________________

____

2. INTERNATIONAL RECIPES: HOMEFUN

Students will enjoy watching and helping with the preparation of family favorites at home, as they write down the recipes.

Procedures:

Large group, teacher-led.
Children working with family members at home.

1. Introduce the lesson by showing the students several cookbooks. Ask students what these are for, and if they are used in their homes. Clarify, for anyone who needs it, what a cookbook is, and how it is used.

2. Explain that the class will make a project of preparing an international cookbook. Discuss favorite dishes of students in the class, and have students make tentative commitments as to what recipes they will contribute so that you will get a variety of dishes. Ask students to tell what food groups are represented in the recipes they plan to contribute, and try to get a balance of foods from the four groups. Discuss the nutritional value of the foods students select.

3. Review the names of dishes prepared during the role play, and the terms on the cooking tools and terms chart. You may wish to have students copy terms into their own personal dictionaries (small stapled books, one page for each letter in the alphabet).

4. If some students, new to English, are not comfortable with writing English, ask them to watch carefully as a family member prepares a favorite dish from the student's culture of origin. The next day, have the student dictate directions for preparing the food to you or to another student more proficient with writing. Use the recipe form for taking dictation.

5. Students who are beginning to write may take the recipe form home to complete as they watch a family member prepare a dish. Discuss how parents may not actually measure all ingredients, and that the students may have to measure or estimate the measurement of each item.

6. Give the students from several days to a week to collect recipes, to allow for busy family schedules.

Evaluation:

Observe students' participation in the discussion for their correct use of cooking and food terms. Note strengths and weakness in written language shown on "rough draft" recipes.

Extensions:

1. Students (or parents) may enjoy bringing in samples of favorite recipes from their cultures of origin for classmates to taste. Ask for a volunteer each day to bring an item for "a taste of culture" week.

2. Encourage students who are not ready to write recipes in English to bring in recipes in their native languages (preferably with pictures). These can either be included in the cookbook in the native language, or you can find someone to translate them into English.

Materials: Paper, pencils.
Cookbooks, including picture cookbooks (See references).
Recipe forms (sample provided on the opposite page).

3. COOKING FOR ONE OR A MILLION: MULTIPLES

Students can see the purpose for knowing how to multiply and divide whole numbers and fractions when these operations are used to adjust quantities of recipes for different family sizes.

Procedures:

Large group, teacher directed
Pairs, teacher available

1. Discuss the fact that recipes are often made for six or eight servings, and many times people either are only cooking for a few or are cooking for a crowd, and need to find a way to change the recipe to suit their needs. Ask students how this might be done.

2. Select a recipe from the those that the students have brought in. As a student reads the recipe to you, list the ingredients and quantities on the chart or blackboard. Make three columns next to this list for quantities of the ingredients. Write the number the recipe serves at the top of one column, and list the quantities in the recipe in that column. At the top of s second column, write the numeral 2. Explain to the students that this column is for the quantities of ingredients for a very small family. At the top of the third column, write the numeral 24. Explain to the students that this column is for enough ingredients to serve the whole class. These numbers may be changed to make the calculations easier or more difficult, depending on the capabilities of the class.

3. Determine a formula for changing the quantities to a recipe to serve 2. For example, if the original recipe serves 6, the formula would be "divide each amount by 3." With coaching from the students, perform the calculations and enter the amounts on the chart. Assign a student to check your arithmetic using the calculator. If students have been taught conversions of fractions to decimals and vice-versa, this is a fine time to use those skills. If they have not been taught, this is an appropriate occasion for their introduction. If students are not ready for this instruction, explain what you are doing, and perform the conversions yourself, or change recipe amounts to whole numbers that are multiples of 2, so that students can use operations with whole numbers.

4. Explain to the students that cooking is not exact, and that sometimes they will have to adjust ingredients a little, rounding off numbers. For example, 1/8 Tsp. divided by 3 becomes a few grains, and 2 eggs divided by 3 can be rounded off to one egg. Use opportunities to review conversions of measures, as well. Eight cups becomes 2 quarts, etc.

5. Repeat the process, determining a formula for changing the quantities to a recipe for 24. This time, assign the calculations for each ingredient to a different pair of students. Show younger students who are not yet comfortable with multiplication and division how to solve the problem by addition or subtraction. Check computations with a calculator.

6. After students have been successful in adjusting quantities in the group exercise, divide them into pairs, and ask them to make similar charts for the recipes that they brought from home. These charts will be used in the next activity, in which students will make cookbooks.

Materials: Recipes from home (see Activity 2).
Blackboard or chart paper.
Paper and pencils for pairs of students.
Calculators.
Language master and cards (optional).

PEACH ICE CREAM

Number of Servings			Ingredient
2	6	24	
2/3 Cup	2 Cups	8 Cups	Crushed Ripe Peaches
1/2 Cup	1 1/3 Cup	5 1/3 Cups	Sugar
Few Drops	1/2 Tsp.	2 Tsp.	Almond Extract
Few Grains	1/8 Tsp.	1/2 Tsp.	Salt
2 Tsp.	2 Tbsp.	8 Tbsp.	Flour
1	2	8	Slightly Beaten Eggs
1/2 Cup	1 1/2 Cup	6 Cups	Milk
2/3 Tsp.	2 Tsp.	8 Tsp.	Vanilla
2/3 Cup	2 Cups	8 Cups	Heavy Cream

Evaluation:

Assess understanding of measurement terms by having pictures of the various quantities on language master cards. Have pairs of students quiz one another on whether they can name the term for the pictured unit of measurement and quantity, and check answers using the language master.

Have students check their own computations by using a calculator, or check them yourself. Through noting what kinds of mistakes students make, select students who need more instruction in addition, subtraction, multiplication, or division, of whole numbers and fractions, multiples, and in converting fractions to decimals. Group these students for further work.

Extensions:

1. Expand the chart and continue with larger quantities if students are ready to work with large numbers. What would the quantities be to feed all the students in the school? Everyone in the city?

2. Make a food groups graph. Help students count how many recipes include foods from each group, and transfer the information to a bar, line or pie graph.

4. PUBLISHING A COOKBOOK: WRITING PROCESS

Take students through the steps of the writing process to produce a revised and published International Cookbook. All their work in learning cooking terms, measurement, collecting recipes, and calculating quantities will be rewarded by an original class book to have and to hold (and to read!).

OUR
RECIPES
ICE CREAM

Procedures:

Small group with adult
Individual, with and without adult

1. Have students work in small groups or pairs to revise the recipes they have brought for inclusion in the cookbook (Activity 2). Students may enjoy "role playing," preparing one another's recipes (See Activity 1) to see if the recipes need any additions or clarifications.

2. Meet with small groups or individuals to perform final edits of the recipes. Students may then copy the final drafts and incorporate the ingredients charts they made in Activity 3.

3. Discuss ways to illustrate a cookbook (e.g., drawings, photographs); choose a means that is practical for your class, and have the students illustrate their recipes.

4. Assign "editing pairs" of students tasks concerning the completion of the book, including choosing the title and designing the cover, listing the illustrations, crediting artwork, writing the title page, writing the copyright page, numbering pages, making a table of contents, writing the dedication page, and writing or collecting and editing biographies of authors. Encourage students to refer to these sections of published books for ideas and format.

5. Bind the book by sewing, using a plastic binder with a binding machine, by stapling, or by using ring binders (with reinforcers -- this book will be well-read!).

6. Invite important school personnel (e.g., the janitor, secretary, librarian, or principal) to a publication party. Prepare selections from the book to be read aloud, and serve prepared samples of some of the recipes.

7. Put a pocket and card in the back of the book, and encourage students to check it out to take home and share with their families.

Evaluation:

Note how shabby the cookbook becomes from many readings in class during choice reading, from handling by visitors, and from many trips into students' homes. Note whose names appear on the card.

Extensions:

1. Ask a volunteer to help students with editing and/or typing the students' revised and edited recipes. Have the students add illustrations, and duplicate the compiled recipes so that each student receives a copy of the cookbook. This will make a lovely special occasion gift for a family member.

2. Ask students to select from recipes in the cookbook to plan a balanced meal, using foods from each of the four food groups.

OUR
RECIPES
ICE CREAM

Materials: Paper, pencils, pens.
Art materials for illustrations.
Word processor or typewriter (desirable if available).
Bookbinding materials.
Assorted published cookbooks for adults and children (see references, and/or ask students to bring cookbooks of their native cuisines).

5. PIZZA PREFERENCES: GRAPHING / FOOD GROUPS

Students will review the four food groups by sorting and classifying pictures. They they will apply their knowledge by selecting foods from the groups to put on a pizza, and graph their choices of toppings.

Procedures:

Small independent groups
Large group, teacher directed

1. Divide the students into small groups of four or five. Try to balance the groups by language proficiency. Have students review the four food groups and food vocabulary in general, by giving each small group a pile of food pictures and asking the students to name the foods and sort the pictures into the four food groups. Give students 5-10 minutes to work on this task. Tell them to make a fifth pile for foods they are undecided about.

2. Invite a representative from each group to bring up the sorted pictures, one food group at a time. As they put the pictures in the appropriate box, have the representatives name the foods. Other students in the class may question the categorization, and give reasons why the food should be placed in another box.

3. As pictures of foods from each group are placed in a box, discuss the contributions of foods in that group to the students' health, growth and development. Stress the importance of eating a balanced diet with foods from all four groups at each meal.

4. After all the items have been sorted, ask groups to take turns holding up foods they had trouble deciding about. Discuss the fact that many foods are combinations of foods from two or more groups. Discuss the value of items that contain foods from several groups. Ask the students to name the countries from which these combination foods originate.

5. Have each group designate one person as scribe, and ask the groups to brainstorm for examples of dishes that contain all four food groups (e.g., ham, cheese, and tomato sandwich, lasagna, or tacos) and list them. Ask a spokesperson for each group to share the list with the class, and make a combination list on the blackboard of all the different items students have named.

6. Tell the students that you have decided that it would be fun to make a four food groups dish in class, and that you've decided on pizza. However, you don't know what toppings they like on their pizza. Ask students to name some of the toppings they like most and list these across the bottom of the chart paper.

7. Assign each topping a color (e.g., red for pepperoni, white for onions, green for peppers, brown for anchovies, yellow for cheese). Ask different students ("passers") to be responsible for passing out each color.

8. As students choose their three favorite toppings, have passers give them corresponding colored squares.

Materials: Chart of the four food groups.
Pictures of foods from magazines (assign each student to bring in 10).
Four boxes, labeled "bread," "dairy," "meat," and "fruits and vegetables."
Squares (about 2") of construction paper in assorted colors.
Chart paper and tape or glue.
"Sticky dots" of various colors, or other means for coding food pictures.

9. Have students take turns bringing their colored squares of paper up to the chart and pasting or taping them on the chart, to make a bar graph that will look something like the one below.

10. Ask students a few questions which require them to use information on the graph, e.g.: What is the most popular topping? How many more people like pepperoni than olives? What percentage of the "votes" went to cheese?

11. Warn the students that some of the questions you might ask can't be answered by using the information on the graph. Encourage them to watch out for questions which can't be answered with the information at hand, then mix in questions like these: Why don't very many kids like anchovies? (An opinion question) How many green peppers will we need? (A question that needs more information)

12. Ask the students to work in small groups again, and to think of several questions to ask the class about the graphs. One of the questions from each group should be a "trick" question, one which cannot be answered by using the information on the graph.

13. Discuss the questions which students ask. Encourage students to use the information on the graph and mathematical concepts to answer questions when they can, and to recognize when the question cannot be answered by looking at the information on the graph.

14. Explain that the pictures will reappear soon at the "Four Food Groups Learning Center."

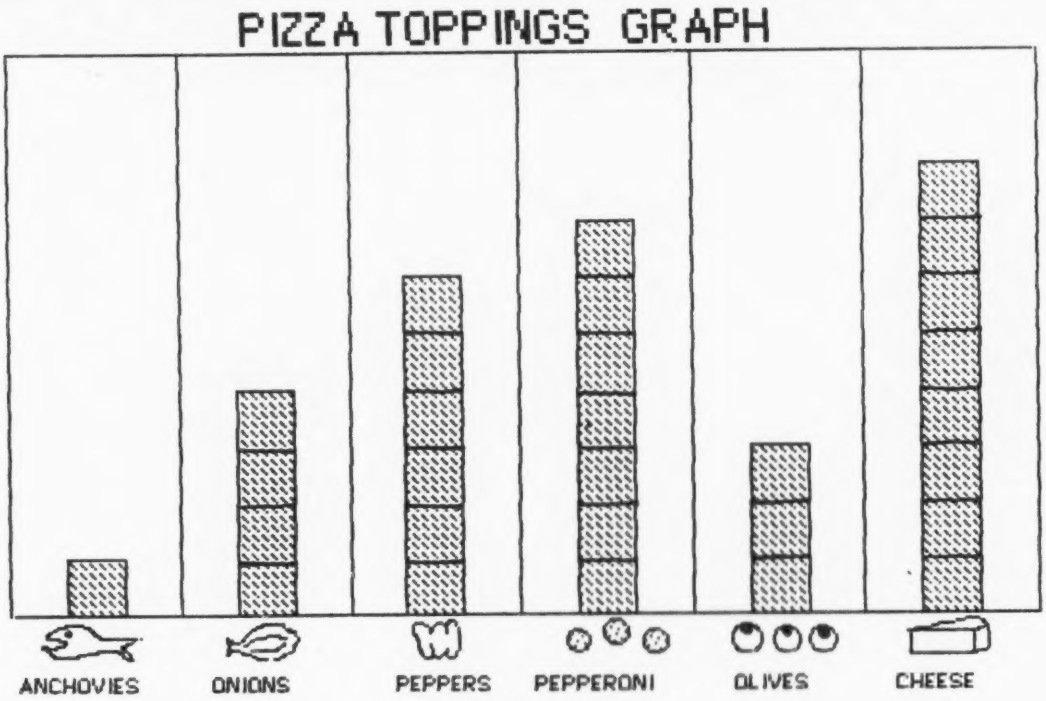
Evaluation:

Teachers can use informal, observational evaluation of the quality of students' questions and answers. Anecdotal records can be kept on student responses. Compile some of the questions that the groups developed and give them to students to answer either on paper or on cassette, depending on students' language proficiency. Use student responses at the learning center to assess knowledge of food names and food groups.

Extensions:

1. Color code the food pictures by placing colored dots on the backs of the pictures. Set up the labeled boxes and the food pictures in a learning center. Have students, working in pairs, name and sort the pictures into the appropriate box. When they have finished, they can turn the pictures over and check their answers with the colored dots.

2. For students who do not yet know the names of all the foods, the food pictures can be clipped or taped to language master cards at the learning center, and pairs of students can practice naming the items, and can check their answers on the language master. If you have no language master, use a more proficient peer to help students practice food terms.



6. PIZZA TOPPING DECISIONS: FLOW CHARTING

This activity introduces the use of a flow chart as a strategy for problem solving and decision making. In this case, the flow chart will help students to provide the right amounts of various pizza ingredients!

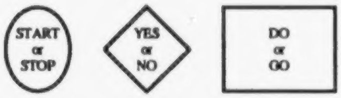
Procedures:

Large group, teacher directed
Independent pairs

1. Remind the students about the pizza project, and review the graph made in lesson one. Tell students that you know who likes what toppings now, but you still need help in deciding which toppings to get, and how much of each.

2. First, which toppings should be supplied? Should the class include toppings that any one person wants, or should a topping have at least a few "votes" to be included? Since the class has been studying the four food groups, shouldn't the toppings represent all the groups (except bread)? Encourage students to discuss which toppings to include, and decide on a limited number, by vote, consensus, or agreed upon criteria (e.g., at least four "votes" on the graph).

3. Next, tell students that they will use something called a "flow chart" to determine how much of each item to buy. A flow chart is a path to guide someone in following instructions and making decisions. Show the students three shapes used in making flow charts, and what each shape indicates. Make a big diamond (decision), rectangle (instruction), and oval (start or stop) to keep on the classroom wall during the time you will be studying and discussing flow charts.



4. Show students the Pizza Topping Flow Chart. This chart will guide students to compute how much of each ingredient, in cups if possible, will be needed for the pizza-making. Select an item, and use the flow chart to determine how much of that item will be needed. Refer to the Pizza Topping Preference graph to determine how many want that item. Add to the total for guests or seconds.

5. Have students estimate the amount of topping needed for one serving by measuring tablespoons of rice and sprinkling them on the small plate. Some items, such as pepperoni, might need to be measured in another way, e.g., number of slices per serving.

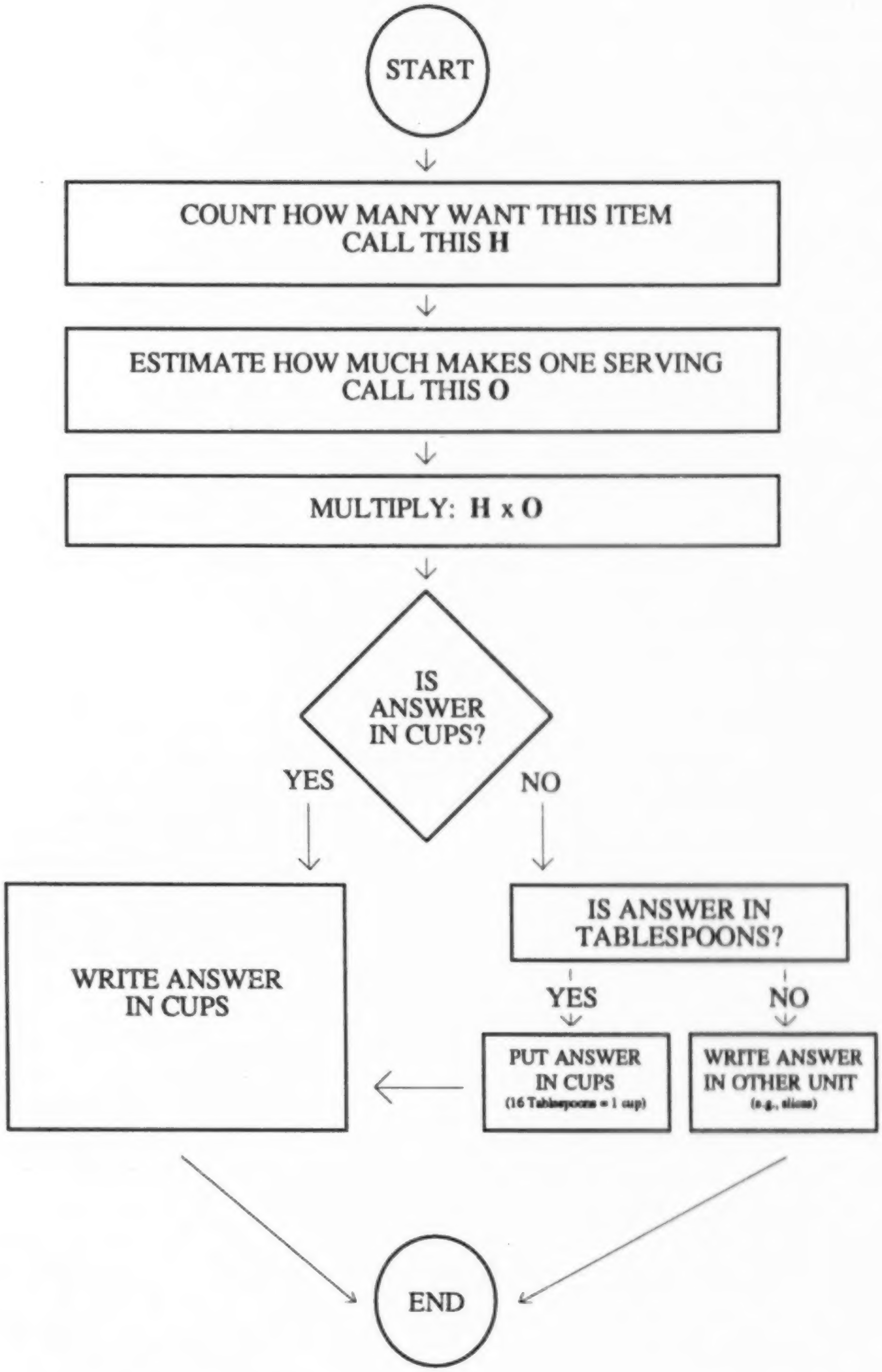
6. As amounts are computed, make a chart on the blackboard or chart paper showing amounts needed of each ingredient (see sample below). Compute a few ingredients

INGREDIENTS NEEDED FOR PIZZA

INGREDIENT	AMOUNT	PERSON(S) BRINGING
Refrigerator biscuits	40 (4 packages of 10)	Tran (2) Carlos (2)
Sauce	4 cups (2 pint jars)	Mr. Mozzarella (1) Simon (1)
Cheese	3 cups grated	Maria
Pepperoni	50 slices	Khan

Materials:
Pizza Toppings Graph.
Paper, pencils.
Blackboard, chalk.
Pizza topping flow chart on chart paper or transparency.
Measuring spoons.
Rice.
Small plate.

PIZZA TOPPING FLOW CHART


START
COUNT HOW MANY WANT THIS ITEM
CALL THIS H
ESTIMATE HOW MUCH MAKES ONE SERVING
CALL THIS O
MULTIPLY: H x O
IS ANSWER IN CUPS?
YES
NO
WRITE ANSWER IN CUPS
IS ANSWER IN TABLESPOONS?
YES
NO
PUT ANSWER IN CUPS
(16 Tablespoons = 1 cup)
WRITE ANSWER IN OTHER UNIT
(e.g., slices)
END

with the class group, then assign pairs of students to follow the flow chart in computing the rest. Assign several pairs the same topping, and compare answers to check. When students have completed the task, compare answers and clear up misunderstandings about using the flow chart.

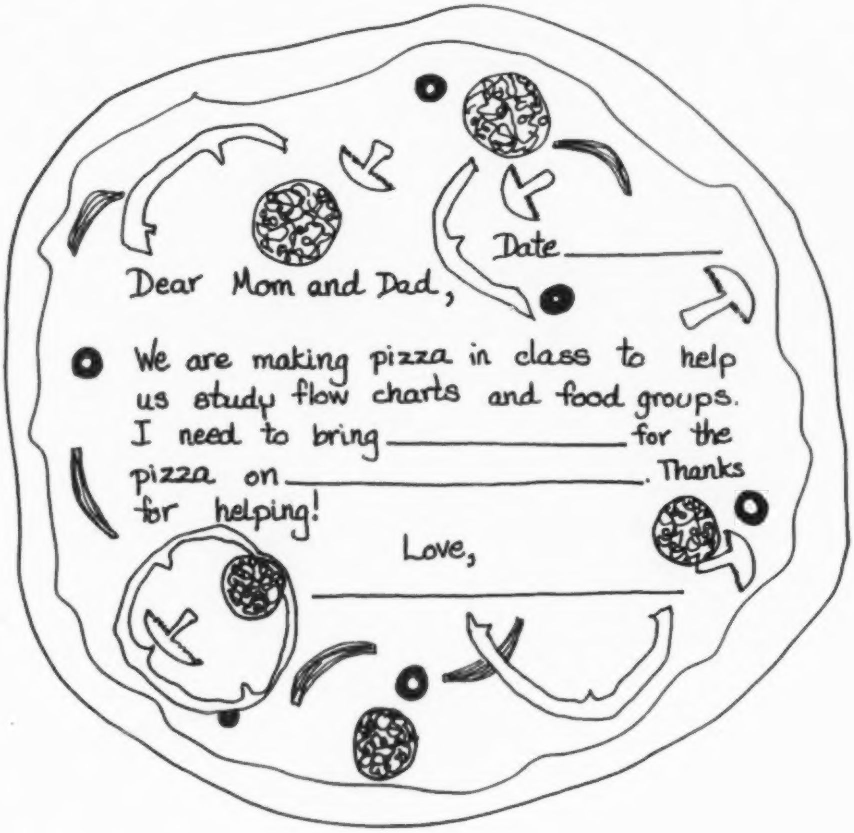
7. When the needed ingredients and amounts have been determined, ask for volunteers to bring various ingredients. Have the students write, copy, or fill in blanks on a letter to their parents asking for this ingredient on pizza day. See the sample letter below.

Evaluation:

Ask these questions of students' performance (and adjust teaching accordingly): Are students' errors due to inaccuracies in computation or to lack of understanding of the process of using a flow chart? Are students interested and actively participating? Does the lesson meet the needs of beginning students as well as more proficient students? Are the students working effectively in pairs?

Extension:

You can simplify or increase the difficulty of computing amounts needed by allowing students to do more or fewer steps independently, or by altering the amounts they use for computation (e.g., for younger or less proficient students, use whole numbers; for older, more proficient students, use fractions).



Date________

Dear Mom and Dad,

We are making pizza in class to help us study flow charts and food groups. I need to bring ____________ for the pizza on ______________. Thanks for helping!

Love,

____

7. PERSONAL PIZZA DAY

Finally, Pizza Day has arrived! Students will make pizzas, and make choices about topping them, as they actually walk through a flow chart.

Procedures:

Large group
Small groups at center

1. Make the flow chart instructions for pizza making on table and/or the floor, so that students may actually walk through the steps on the chart. See the Pizza Making Flow Chart below.

2. Direct one or two students in a "dry run" through the flow chart as the class observes. Carefully demonstrate the processes (e.g., how to flatten the dough and how to measure and sprinkle toppings) and discuss all the decision points. Use the decision point regarding the shape of the pizza to discuss the optional shapes for pizzas. Ask questions that will help students plan the pizza, e.g., "What shape pizza would have the most area?" or "What are the advantages of a thick or a thin pizza?

3. Assign small groups to use the flow chart to prepare their personal pizzas one group at a time, while other groups work at another activity. Monitor oven use carefully.

4. Pizzas can be identified by writing the name of the cook in pencil on greased foil squares, and placing the pizza on the foil so that the name shows.

5. When pizzas are finished, have students eat and enjoy them while discussing how they made all the right choices on the flow chart!

Evaluation:

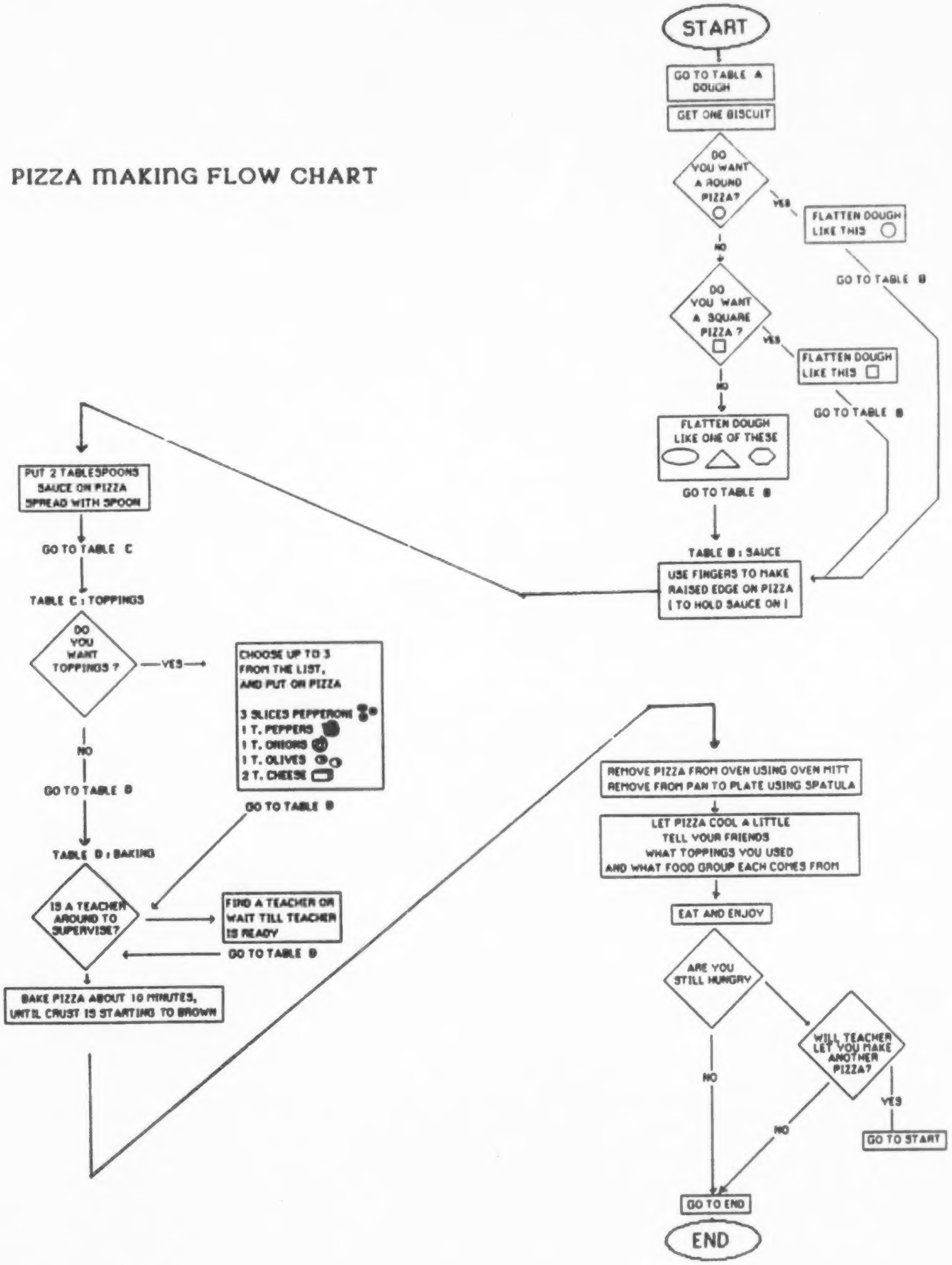
Observe the activity, and ask these questions: Did students have fun? Was there much informal language learning involved with the pizza making, with students assisting one another when needed? Were students able to understand and follow the instructions on the flow chart? Students will have a chance to demonstrate their understanding of flow charting in Activity 8.

Extension:

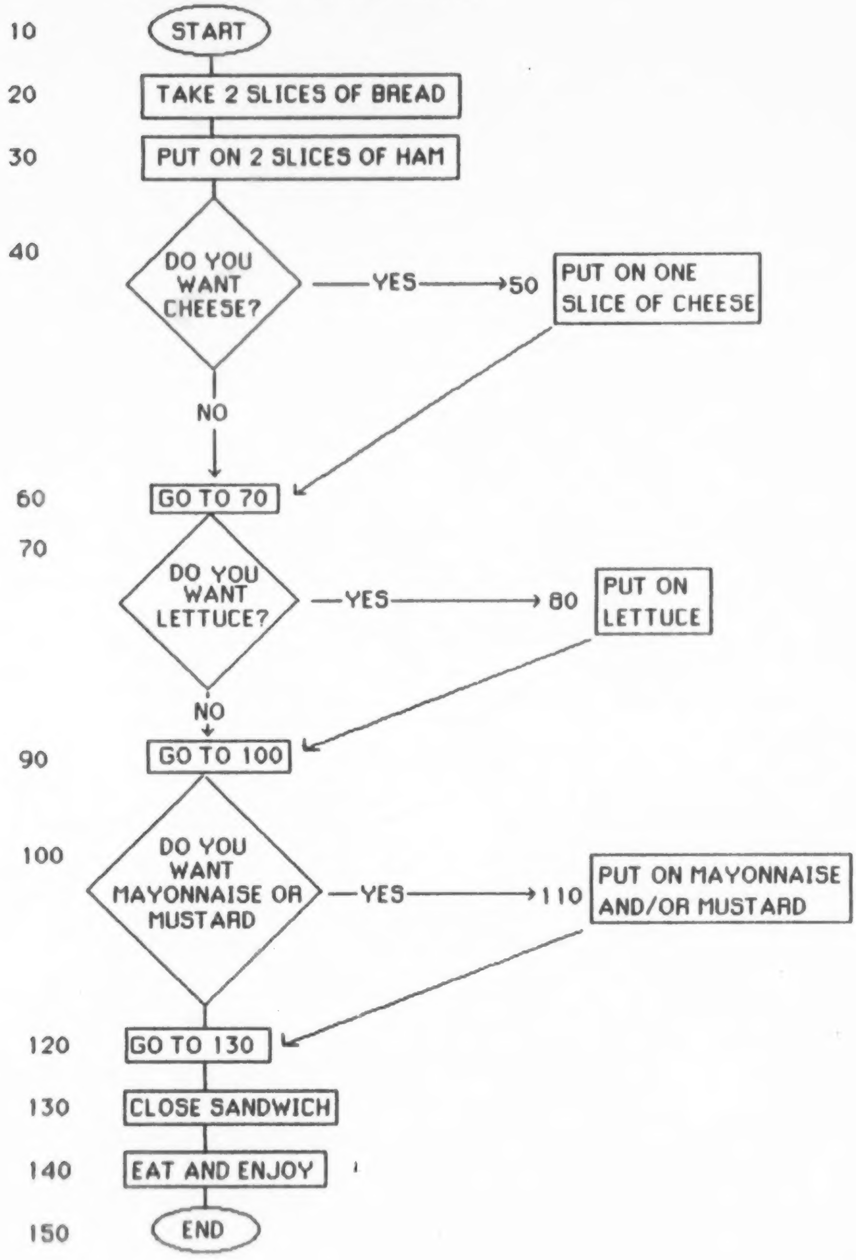
Invite honored guests (parents, school personnel) to join the class to prepare and eat pizzas. Have students guide the guests through the flow chart.

Materials: Pizza ingredients you listed on the chart in Activity 6.
Cookie sheets (if oven in kitchen is used).
Small trays (if toaster oven is used in class).
Foil squares, one for each student.
Grease for cookie sheets or foil squares.
Spatula, knife, pizza wheel.
Paper towels, plates, napkins.
Drinks and cups (optional).

PIZZA MAKING FLOW CHART


START
GO TO TABLE A DOUGH
GET ONE BISCUIT
DO YOU WANT A ROUND PIZZA? ○
YES
FLATTEN DOUGH LIKE THIS ○
GO TO TABLE B
NO
DO YOU WANT A SQUARE PIZZA ? □
YES
FLATTEN DOUGH LIKE THIS □
GO TO TABLE B
NO
FLATTEN DOUGH LIKE ONE OF THESE
GO TO TABLE B
TABLE B : SAUCE
USE FINGERS TO MAKE RAISED EDGE ON PIZZA (TO HOLD SAUCE ON)
PUT 2 TABLESPOONS SAUCE ON PIZZA SPREAD WITH SPOON
GO TO TABLE C
TABLE C : TOPPINGS
DO YOU WANT TOPPINGS ?
YES
CHOOSE UP TO 3 FROM THE LIST, AND PUT ON PIZZA
3 SLICES PEPPERONI
1 T. PEPPERS
1 T. ONIONS
1 T. OLIVES
2 T. CHEESE
GO TO TABLE D
NO
GO TO TABLE D
TABLE D : BAKING
IS A TEACHER AROUND TO SUPERVISE?
FIND A TEACHER OR WAIT TILL TEACHER IS READY
GO TO TABLE D
BAKE PIZZA ABOUT 10 MINUTES, UNTIL CRUST IS STARTING TO BROWN
REMOVE PIZZA FROM OVEN USING OVEN MITT
REMOVE FROM PAN TO PLATE USING SPATULA
LET PIZZA COOL A LITTLE
TELL YOUR FRIENDS
WHAT TOPPINGS YOU USED
AND WHAT FOOD GROUP EACH COMES FROM
EAT AND ENJOY
ARE YOU STILL HUNGRY
WILL TEACHER LET YOU MAKE ANOTHER PIZZA?
YES
GO TO START
NO
NO
GO TO END
END

HOW TO MAKE A HAM SANDWICH


10
START
20
TAKE 2 SLICES OF BREAD
30
PUT ON 2 SLICES OF HAM
40
DO YOU WANT CHEESE?
YES
50
PUT ON ONE SLICE OF CHEESE
NO
60
GO TO 70
70
DO YOU WANT LETTUCE?
YES
80
PUT ON LETTUCE
NO
90
GO TO 100
100
DO YOU WANT MAYONNAISE OR MUSTARD
YES
110
PUT ON MAYONNAISE AND/OR MUSTARD
120
GO TO 130
130
CLOSE SANDWICH
140
EAT AND ENJOY
150
END

8. FLOW CHARTS EVERYWHERE: HOMEFUN

Students put their new knowledge of flow charts to work to help them solve problems or to give instructions for a task.

Procedures:

Large group
Individual with parent
Small groups

1. Ask students what tasks they help with at home. Do they sort laundry? Wash dishes? Cook? Take care of little brothers or sisters. Ask students to give you the instructions for a simple task that involves some decisions, e.g., washing clothes or making a ham sandwich. As they tell you the instructions, draw the flow chart on the blackboard. (See sample on page 20 for ideas, but use students' ideas as well.) Encourage students to make suggestions for revision of the chart as you go along, and erase and make changes.

2. This flow chart introduces the numbering system that programmers use to write programs for computers. They often make flow charts as a preparation for writing a program. Explain how the numbering system makes it easy for the person reading the chart, or for the computer, to get from one place to another in the program, and how the numbering leaves space for adding steps that have been left out. Review concepts of place value, and how they relate to this means of numbering.

3. When you and the students are satisfied with the flow chart you have created, have students copy it as a model, or have one student copy it on a ditto and reproduce it for the rest.

4. Give the assignment for making a flow chart for performing a simple task at home, such as preparing a food item. Encourage the students to watch carefully as someone performs the task at home, observing, and asking questions about the steps and decisions made. Adjust the assignment for your group, or for individuals in the group (e.g., beginning English- speakers might draw the chart all in pictures, rather than writing words). Requirements might include one or more of these:

Watch a parent or older person perform a household task.
Make a flow chart for performing a household task.
Make a flow chart for preparing a snack using all four food groups.
Include at least one decision.
Use the flow chart symbols: oval for start and stop, rectangle for directions, diamond for decisions.
Rewrite directions from a package or game as a flow chart.
Include both standard and metric measures in your flow chart.

5. Explain to the students that their homefun activity is a "first draft" for a flow chart, so they should concentrate on accuracy of the chart, not on neatness or attractiveness. They will be revising the charts in class.

Evaluation:

Evaluate the students' assignments to see if they have met the requirements. Record student performance on a checklist.

Extension:

With the students, find other uses for the numbering system used by programmers. Use it for outlining or when alphabetizing, so a word or line which has been left out can be added.

Materials: Blackboard and chalk.
Pencil and large newsprint paper.
Poster of shape templates.

9. FLOW CHART POSTERS: FINALE

Students use the writing process to develop their "rough" flow charts into beautiful flow chart posters to decorate the halls, showing everyone in the school how much they have learned in this unit.

Procedures:

Large group, teacher directed
Small independent groups
Individual work

1. Make a "homefun" flow chart of your own. Make a number of errors in the chart: instructions out of order, wrong symbol, spelling errors, etc. Put your flow chart on the wall. Show the students your flow chart, and explain that you want them to "conference" with you about your chart.

2. Explain that there are three steps to a good conference, and that they can use the letters "PQP" to help them remember these steps. Write "PQP" on the blackboard or on a chart.

3. Tell the students that the first P stands for "praise." Write "praise" next to the "P." Students should find something they like about the other students' work, and tell them. Ask the students to find something they like about your chart, and tell you what it is.

4. Ask the students what they think the "Q" stands for. Elaborate on their answers, explaining that the next step is for students to ask "questions" about one another's work. They can ask for more information if it is needed, for the reasons why someone chose this topic, or other questions to get students to reflect on their work. Ask students to ask you some of these questions about your chart.

5. Explain that the second "P" stands for "perfect." Now students can offer one another, in a kind and helpful way, some things that might improve the piece. Remind students how hard it is for them to be criticized, and help them find gentle ways to suggest that you correct some of the errors on your chart. Help them find some of the errors that you have made. Encourage them to look for (a) clear directions, in the right order, (b) appropriate use of the flow chart symbols, and (c) appropriate spelling and usage for their grade level and proficiencies.

6. Ask students to work in small groups, and to follow the "PQP" process with the members of their groups. Circulate among the groups to add your feedback, and to monitor the group process.

7. Now that the students have some feedback on their flow charts, they can work individually to make revised flow charts on large poster paper. Select a color for each symbol (e.g., yellow diamonds for decisions, green oval for start, red oval for end, blue rectangles for instructions). Have students cut out the shapes they need, write instructions on them using markers, and lay them out on the large paper. Encourage students to add illustrations to make the charts clearer and more interesting.

8. Check each student's flow chart when it has been laid out, but before it has been glued. Make sure that students give their flow charts a title, and that the name of the author/artist is included.

9. When charts are finished, students can stand up in front of the class to read and/or describe them, and then charts can be placed in the classroom or hall for display.

Materials: Teacher-made flow chart, on large paper or transparency.
Cardboard for shape templates.
Colored construction paper.
Large white or light colored paper.
Markers.
Scissors.
Tape or glue.

Evaluation:

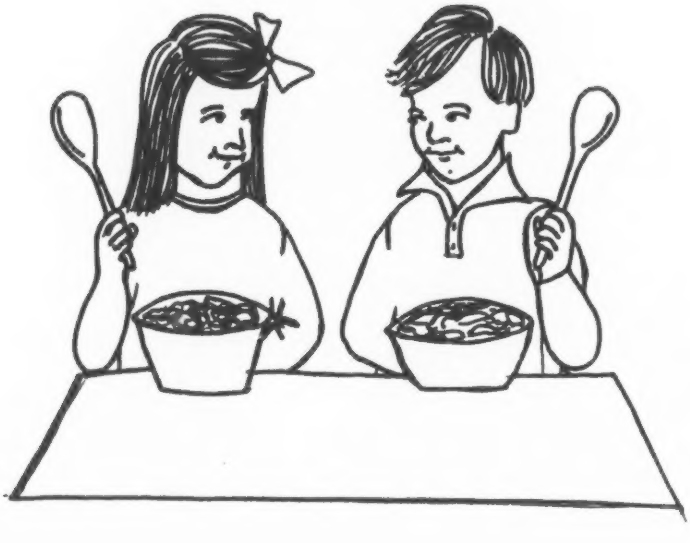
Observe the students in small groups to evaluate their conferencing skills. Understand that these skills are not developed in a day. Look at the students' finished products to observe for creativity, correct understanding of how to create a flow chart, knowledge of the numbering system used in programming, and writing skills.

Extensions:

1. Use flow charts to give instructions in the learning center.

2. Make flow chart instructions for using classroom equipment, such as the language master, the tape recorder, the filmstrip viewer, or the listening center.

3. Make a flow chart of a "Choose Your Own Adventure" book, showing the decision points.



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